DEC 28 1916

THE IRON TRADE REVIEW

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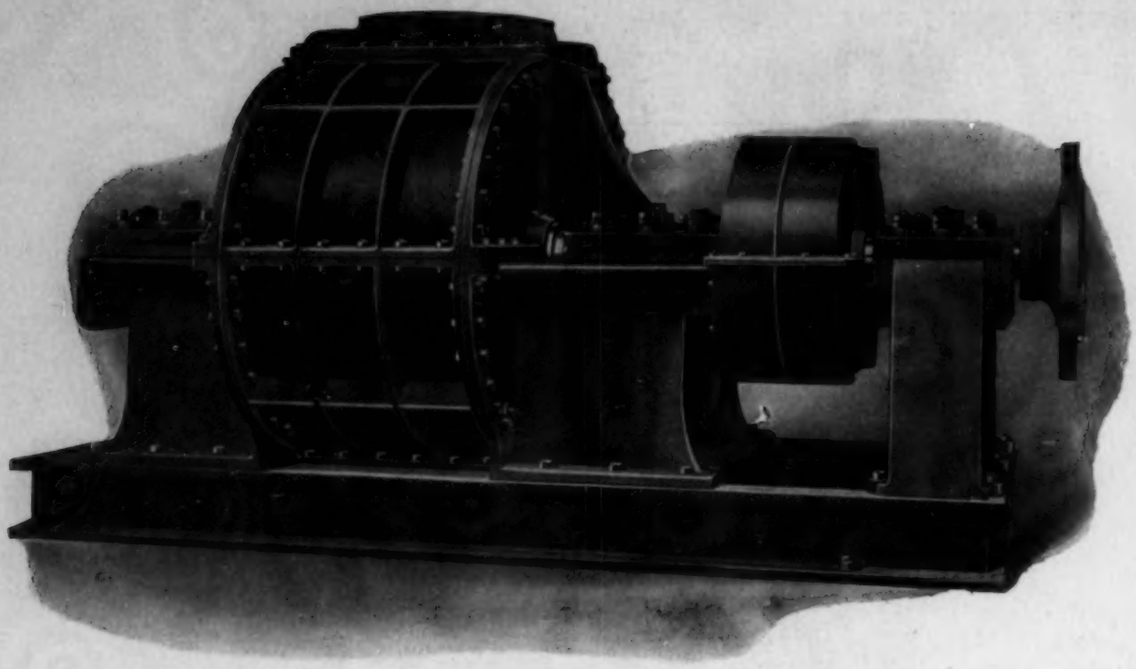

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THE IRON TRADE REVIEW

Vol. LIX Cleveland, December 28, 1916 No. 26

Foreign Buyers Are Persistent

Are Pressing Pig Iron Inquiries and Are Also in the Market for Large Tonnages of Finished Materials—Railroad Congestion Causes Much Trouble

THE old year is drawing to a close with conditions similar to those of last year, but intensified in some respects. This week, as in the last week of 1915, the mills are overwhelmed with orders and the pig iron market is extremely strong, but the trouble in making deliveries of raw materials and finished products which was beginning to be complained of a year ago is now extremely serious. Many blast furnaces are banked on account of slow delivery of coal and coke and many others have been slowed down so as to reduce the amount of fuel consumed. At finishing plants, there is general complaint in regard to railroad service.

Continuing liberal bookings and reduced shipments will bring about another considerable increase in the Corporation's unfilled tonnage for December.

The Trend of Prices

Two years ago, the minimum quotation on plates, shapes and bars was 1.05c, Pittsburgh. The announcement made last week of advances on bars to 3c, Pittsburgh, 3.10c on shapes and 3.60c on plates and axles caused not a ripple of excitement and extraordinarily high premiums continue to be paid for prompt delivery. A year ago, the usual quotation on standard shapes was 2c, Pittsburgh, but some mills were beginning to quote 2.25c, while on plates, 2.25c was the minimum with eastern mills. Price advances nowadays are taken as a matter of course and specifications come in just as freely as when quotations were lower.

Plates

A large independent platemaker, who several days ago announced he would entertain propositions on a certain amount of ship steel for the first half of 1917, has been deluged with inquiries. The total of these is stated to be about 100,000 tons, nearly all of which is for export. This maker is asking 6c, Pittsburgh, on ship plates, but is not willing to sell at this figure beyond the third quarter. Domestic ship yard inquiries are not so numerous. Other classes of plates than ship steel show a sustained heavy demand.

Pig Iron

The principal activity in pig iron is in persistent inquiries from foreign countries. Sweden and Japan have sent out new inquiries and an effort has been made to buy 10,000 tons for Italy at from $1 to $2 below recent quotations, but the market remains firm without concessions being made to either foreign or domestic buyers. Standard low phosphorus pig iron in the east has sold at more than $55, furnace, an advance of $25 during the year. A sale of 2,000 tons was made at the new high price for export to Japan.

Railroad Buying

Car awards for the week amount to about 4,000. Russia is still in the market for a large number and may buy as many as 20,000. A new inquiry is for 5,000 to 6,000 tons of light rails for trench service in France. French state railroads have ordered 100 more locomotives, and the Paris and Orleans line, 50. Increased pressure on plate mills is attributed largely to efforts of car builders to cover for orders for cars recently placed or about to be placed. The Corporation now is practically sold up for first half of 1918 on rails. The Erie's order now closed gives the Carnegie Steel Co. 25,000 tons.

Coke

Unsatisfactory conditions in the Connellsville coke regions have been made worse by coke workers insisting upon remaining idle during a considerable part of the holiday season. Furnace coke for prompt delivery has sold as high as $12 and it is predicted that $14 may be paid within a few days.

Tin Plate

Tin plate is now quoted at $7.50 to $8 per base box, compared with $5.75 to $6 when the season opened. It seems probable that the price for the third quarter of next year will be from $7 to $7.50, although it may be considerably higher.

THE OPEN HEARTH

Steel Makers Favor Honorable Peace—Discuss Post Bellum Conditions

THAT prosperity in the steel trade does not depend upon the war, but whether it does or not, steel manufacturers are in favor of peace when it can be honorably obtained, and that they are in favor of making any reasonable effort that can be made to hasten the restoration of peace is shown by the expressions of opinion by presidents of leading companies. In response to telegrams sent to a few presidents of representative companies by *The Iron Trade Review,* the following replies were received. Several other officials expressed disinclination to discuss peace at the present time:

Expects Keen Competition

By E. G. Grace,

President Bethlehem Steel Co., South Bethlehem, Pa.

You ask my personal opinion as to the possibility of peace being restored in Europe. As much as we would like to see this condition come to pass quickly and conclusively, we fear it is not as near at hand as the present agitation toward that end might indicate. It is our opinion that to no great degree have the issues involved been satisfied. Not like some of our friends, we believe there are definite and great issues and differences being contended for. If the affairs between the contending countries have reached the stage where peace terms can be agreed upon not only as pertaining to the present contending countries, but to the world at large, we firmly believe that such a peace is most desirable for ourselves as well as for the countries now at war.

The steel industry of the United States need have no feed fear for its future, if permitted to operate under proper and just laws. These laws must be enacted with a full knowledge that we will have keener competition from at least two important iron and steel manufacturing countries than we experienced before the war. This is due to the awakened and energized organizations of their industries necessitated by the war conditions which have come upon them and which they have so ably and amply met.

Not Dependent Upon War

By John A. Topping

Chairman, Republic Iron & Steel Co., New York

It is my opinion that prosperity in the steel trade is not dependent upon war; on the contrary, peace established on a lasting basis is the only way to insure permanent prosperity. Therefore, any effort put forth in this direction by our government to promote permanent peace is a move in the direction of more permanent prosperity.

Desirable as peace is, all business men, I think, recognize that preparedness for peace is imperatively necessary, because peace will bring with it its problems. Neither should we overlook the fact that our tariff exposes the steel trade to unfair foreign competition, because our defensive position is weak, our free list extensive, wages high and labor inefficient, whereas the reverse of this is true in the countries now at war, because labor abroad has been made more efficient by war necessities and the facilities of foreign producers more nearly up-to-date than they have been heretofore. Furthermore, co-operative conditions are more effective and beyond this, tariff restrictions have been established or are in contemplation, which makes our problem more difficult.

The steel trade and other business as well, should not only be authorized to syndicate or pool their foreign business under some co-operative plan, as has been outlined and recommended by the federal trade commission, but should be permitted to *co-operate in every practical way at home to stabilize values.* If financial markets require protection against upset conditions through the support of the federal reserve bank act, why should not the federal trade commission co-operate with business as a defensive measure, under present upset conditions, to effect such adjustments as may be necessary?

At present, steel books are filled to overflowing, labor fully employed and prosperity such as we have never known exists, and there is still a large unsatisfied demand for steel which, I believe, will express itself later on, whenever values have been reasonably stabilized by some such practical measure as I suggest.

In my opinion, existing conditions fully justify putting aside politics and warrant putting into effect practical business measures to insure continued prosperity and stability of values. This, I think, can be unquestionably influenced through a proper revision of the tariff and by co-operative methods, and peace should be welcomed rather than feared.

Meddling Might Do Harm

By A. F. Huston,

President, Lukens Iron & Steel Co., Coatesville, Pa.

I am heartily in favor of peace as soon as it can be brought about, but I question very much whether our meddling in at this juncture will be productive of good. Germany's bellicose utterances taken with Lloyd George's recent speech in Parliament show positions which seem irreconcilable at present, and we may only make matters worse. Neither Germany nor England has treated us with proper consideration, but if we could end the war, we ought to make great sacrifices to do it. Certainly we do not want to make matters worse, which I greatly fear we will by mixing in at this time. Our company does not make munitions.

Expects War to Continue

By G. H. Jones,

Vice President, Inland Steel Co., Chicago

While we hope for an early peace in Europe, it does not appear to us, knowing the temper of both sides,

THE OPEN HEARTH

that there is any immediate prospect of a joint discussion of terms which could be considered and that, therefore, the war will continue for some time and probably through 1917. Should an armistice be declared, or anything else done to stop hostilities, we have no reason to think that the steel business would be affected, to any great extent, for a period of two or three years. Any tonnage available, due to a smaller demand for munitions, would be eagerly taken by domestic customers and foreign buyers who need the steel for other than war purposes. In that event, prices may recede a little and by that we mean that the premiums which are now being paid would gradually disappear.

How to Wipe Out the Deficit

CONGRESS is worrying over the matter of raising revenue. Chairman Fitzgerald of the house committee on appropriations has announced that a treasury deficit of $300,000,000 is practically a certainty in the next fiscal year. His statement is merely a reaffirmation of a fact that has been known more or less generally for some time. Mr. Fitzgerald's position, however, as the "watch dog of the treasury", causes his remark to impress the public mind strongly.

Legislation for the national defense is unjustifiably assigned by some legislators as the principal reason for the deplorable condition of the treasury. That kind of legislation is absolutely necessary and no heed whatever should be given to those in and out of congress who are urging that appropriations for the upbuilding of a strong navy and army be pared down. That is the last thing that should be done.

Congress itself is to blame for the deficit that is being faced. Its unbusiness-like methods have invited such a situation. It has indulged in wild extravagances and follies that not only involve tremendous expenditures, but also are hurtful to the best interests of the country. Unless a halt is called on such procedure, no logical solution of the revenue problem can be expected. Unfortunately, congress as a body does not show the proper tendency toward accepting the remedy. The remedy is a simple, but effective one. It must be applied through public opinion, no matter how strenuously congress may object.

In a word, congress must be made to eliminate "pork". With that done, the revenue situation need cause no worry. It is not a question of raising added revenue so much as it is of conserving revenue that should be taken into account. The doing away with only three certain measures that come to mind would in itself mean a saving of more than $80,000,000, and at the same time inure to the national welfare. These measures appropriate $20,000,000 for a government nitrate plant, $11,0000,000 for a government armor plant, and $50,000,000 for a government merchant marine. No doubt further appropriations will be required to carry out these absurd and even dangerous projects. The saving could be increased still more by striking from the proposed public building bill some $20,000,000 of its total amount of $30,000,000.

In the absence of congress foregoing its scandalous habit of enacting legislation based upon "pork" and selfish politics, it is natural that there is a revulsion of feeling against all sorts of schemes of taxation. It represents an expression of protest against being burdened with levies that are both unjust and entirely unnecessary. The feeling ought to be more active and less passive. The people have it within their power to cure these evils, and the business interests represent an important part of the people. The public is not entirely without blame for permitting these evils to exist. It cannot escape responsibility.

An Important Experiment

AN EXCEEDINGLY interesting feature in the reorganization of the British cabinet is that it embodies an effort to bring about great results by the joint action of representatives of labor and capital. Lord Northcliffe, the distinguished journalist who, more than anyone else, was responsible for the British ministerial crisis, says that England has passed through the biggest revolution since the passing of the reform bill in 1832, which so greatly extended the franchise. In describing the organization of the new cabinet, he says:

"We have smashed our previous conceptions of government by calling in the help of five representatives of labor. We have taken the power from the hands of our party politicians and given it to our ministers without respect to party. We have gathered in the help of the best business brains in the empire."

In other words, three important things have been done: Politicians have been invited to the rear, representatives of labor have been given a prominent part and business men have been summoned to help their country in this hour of its great need. A newspaper correspondent speaks of the business men in the cabinet as vigorous, successful, trained in getting things done and expert in their jobs. If all these men, employers and employes, work together and bring about the results which are hoped for, they will furnish the world positive proof that capital and labor are capable of working together, and such evidence should be of the highest value in bringing them together in a friendly way in many important undertakings in times of peace as well as during a great war.

Prices Present and Past

(Yesterday, a month ago, three months ago and a year ago.)

Quotations on leading products December 27, average for November, 1916, average for September, 1916, and average for December, 1915. Prices are those ruling in the largest percentage of sales at the dates named.

	Prices Dec. 27, 1916.	Aver. for Nov., 1916.	Average for Sept., 1916.	Aver. for Dec., 1915.
Bessemer pig iron, Pittsburgh	$35.95	$30.35	$22.20	$19.85
Basic pig iron, Pittsburgh	30.95	25.95	19.075	18.55
No. 2 Fdy. pig iron, Pittsburgh	30.95	26.76	19.50	18.85
Northern No. 2, Fdy., Chgo.	30.00	25.00	18.65	18.00
Lake Superior Charcoal, Chgo.	33.75	23.00	19.75	19.15
Malleable, Chgo.	30.00	25.00	19.15	18.10
Southern No. 2, Birmingham	23 50	19.60	14.38	14.13
Southern Ohio No. 2, Ironton	30.00	23.60	18.35	17.00
Basic, eastern Pa.	30.50	25.00	20.00	18.00
No. 2X Virginia furnace	26.50	23.00	17.50	17.00
No. 2X foundry, Philadelphia	29.50	25.00	19.75	19.25
Ferro mang., Balti	164.00	160.00	164.00	100.00
Bessemer billets, Pbgh.	60.00	52.00	45.00	29.60
Bess. sheet bars, Pbgh.	60.00	52.00	45.00	30.80
Op.-h'th sh. bars, Pbgh.	60.00	52.00	45.00	30.80
Open-hearth billets, Pbgh.	60.00	52.00	45.00	30.20
Steel bars, Pittsburgh contract	3.00	2.78	2.60	1.74
Steel bars, Chgo.	3.19	2.89	2.79	1.97
Iron bars, Philadelphia	3.159	2.659	2.659	1.959
Iron bars, Cleveland, local del'y	3.00	2.70	2.40	1.75
Iron bars, Chgo. mill	$3.00	$2.52	$2.35	$1.70
Beams, Chgo. contr.	3.29	3.03	2.79	1.97
Beams, Pittsburgh, contr.	3.10	2.88	2.60	1.74
Beams, Philadelphia	3.409	3.059	2.759	1.959
Tank plates, Pbgh., contract	3.60	3.35	2.95	1.74
Tank plates, Chicago contr.	3.79	3.46	3.19	1.97
Tank plates, Philadelphia	4.159	3.909	3.909	1.959
Sheets, blk., No. 28, Pbgh.	5.00	3.67	2.887	2.54
Sheets, blue an., No. 10, Pbgh.	4.50	3.30	2.925	2.23
Sheets, galv., No. 28, Pbgh.	7.00	5.07	4.22	4.75
Wire nails, Pittsburgh	3.00	2.85	2.60	2.02
Connellsville fur. coke, contr.	4.00	3.75	2.48	2.35
Connellsville fdy. coke, contr.	6.00	5.50	3.17	3.00
Heavy melting steel, Pbgh.	24.00	20.55	16.125	17.40
Heavy melting steel, eastern Pa.	24.00	20.00	15.00	16.00
Heavy melting steel, Chgo.	23.50	19.35	15.50	18.40
No. 1 wrought eastern Pa.	28.00	23.50	21.00	20.00
No. 1 wrought, Chgo.	25.00	21.25	16.62	15.15
Rerolling rails, Chgo.	28.50	24.90	16.90	16.70
Car wheels, Chgo.	22.00	15.95	12.00	14.75

(For Additional Prices See Page 1326.)

Many Blast Furnaces Are Banked

On Account of Slow Movement of Coal and Coke—Market Generally Quiet—Principal Demand is From Foreign Lands

Pittsburgh, Dec. 26.—Many blast furnaces were forced to bank fires Christmas, on account of the slow movement of coke. The Carnegie Steel Co. on Dec. 23 banked 14 stacks, but was able to put them into operation today, having accumulated sufficient tonnages of coke to meet requirements. A merchant furnace in this district has been out of blast for more than a week and several other blast furnace stacks have been handicapped seriously, on account of the slow movement of fuel.

The pig iron market is experiencing the usual holiday lull in activity. Scarcely any buying of importance is noted, but prices are holding firmly. Reports of bessemer iron being offered at $32, valley, are heard in isolated instances; most concerns are obtaining $35, valley. A local consumer paid that figure several days ago for 1,000 tons for first quarter delivery. A Pittsburgh melter is in the market for about 10,000 tons of bessemer iron for shipment before July 1. Basic iron is being held at $30, valley, but is quiet. Foundry and malleable irons are selling at as high as $33, although we note sales of 900 tons at about $30, valley.

Largely for Export

New York, Dec. 26.—Such new inquiry for pig iron as has come out during the past week has been largely for foreign account. To all evidences, these foreign consumers see nothing in the prospects for early peace to deter them from continuing to seek metal on this side, especially for shipment during the next several months. Some of them have shown a stronger attempt to develop lower prices, but have not been successful. On 10,000 tons of bessemer for Italy, bids by the prospective buyer of $1 and $2 under the previous market have brought no results. British merchants, within the past several days have brought out new requests for prices on indefinite tonnages of both northern and Alabama foundry iron. Sweden has a new inquiry for 1,000 tons of bessemer and Japan for 1,000 tons of low phosphorus. Holland has inquired for additional small lots and there are also similar requests from South America. New foreign sales are light.

In the domestic market, trading continues practically at a standstill. Sales are of a small and filling-in character. The largest transaction of the week was the purchase of 3,000 tons of first quarter basic by a Perth Amboy, N. J., buyer at $30, eastern Pennsylvania furnace, or about $31 delivered. A few buyers who have been in the market are holding off in the expectation of lower prices, but there are no signs as yet that they will gain their ends. Prices on all sides show firmness and there is no disposition among furnaces to make concessions. One eastern Pennsylvania maker has sold small lots of foundry up to $32, furnace, for No. 2X and has now withdrawn from the market because of coke uncertainties.

Some speculative holders of Alabama warrants have been rendered nervous by the peace developments and have been willing to accept lower prices. It is thought that bids of $21 would be acceptable by some holders. Sales were made in the week, however, at $22.50, Birmingham warehouses, on which negotiations were started over a week ago and there is some figuring on certain analyses at $22.

Railroads Block Furnaces

Buffalo, Dec. 26.—The congested condition of the railroads due to weather conditions, scarcity of cars and labor and the operation of the new law respecting the interchange of cars with foreign roads are proving to be serious handicaps for the furnace interests and consumers alike. Inability to get cars is intensifying

(*For complete prices see page* 1326)

the coke shortage and two stacks have been forced to bank here on this account within the past few days.

Producers find it extremely difficult to secure cars to forward pig iron to melters who are urging deliveries on material under contract. One furnace interest, in a position to load and send out upwards of 40 cars a day, reports that since the new interchange ruling went into effect it is able to secure no more than three or four cars a day.

Coupled with the sold-up condition of the furnaces, the railroad situation has had a tendency to confine activities in the Buffalo market to a few sales closed to meet emergency needs. Producers, being out of the market as far as malleable is concerned, are being called upon to furnish charcoal iron wherever obtainable as a substitute for malleable needs.

The flat price of $35 per ton for any grade and for any available deliveries continues to prevail. There is a complete absence of a schedule based upon grades. Some southern iron has been sold for second and third quarter deliveries of 1917 for users in this vicinity at approximately the same price as the northern irons, but averaging slightly below the Buffalo price of $35 per ton.

Chicago Market Stronger

Chicago, Dec. 26.—Quotations on pig iron are stronger in the Chicago market and foundry and malleable, which had been quoted at $30, furnace, have been sold a dollar higher. Indications are appearing that considerable buying will be done soon after the first of the year and the higher figure will be established or exceeded. Comparatively little inquiry is being entertained at present, but signs of shortage of iron in the hands of melters are beginning to appear.

Furnaces here are sold tight for six months. Bessemer iron is not obtainable in this territory and there is no quotation on this grade. Lake Superior charcoal iron is higher, a recent transaction being on the basis of $32 to $33, furnace, or $33.75 to $34.75, delivered, Chicago.

Southern iron is quiet and unchanged, with small demand except for carloads of prompt delivery offered by brokers from supply on track or in transit. Southern makers are sold so far ahead they are slow to take on new business.

Await Developments

Cleveland, Dec. 26. — The pig iron market is still very quiet and some rather important inquiries sent out a week or so ago have not resulted in orders, as buyers are inclined to await developments. The market is, however, very strong and sellers are just as willing as buyers to play the waiting game. The railroad situation in Cleveland shows a slight improvement as far as the blast furnaces are concerned, but the furnaces in operation have been slowing down, so as to reduce the coke requirements.

Buyers Are Cautious

Birmingham, Ala., Dec. 26.—The natural lull incident to the holidays, coupled with repeated proposed peace overtures, has caused the Birmingham pig iron market to more or less "mark time". However, the producers' market tends to hold firmly, with buyers pursuing a very cautious method of buying. One large purchaser phrased his attitude by saying his future condition did not justify the gamble. As a matter of fact, present conditions have evolved a more or less "gamble" insofar as the foundry consumer of pig iron is concerned, and this is the expressed opinion of many of the large southern buyers of pig iron. Two of the large producing interests are holding their iron at $24 per ton for any delivery next year, and two other large producers at $25 per ton at the furnace. However, there has been offered in the district some warrant iron on the basis of $22 to $23 per ton at the furnace. The insistent "peddling" of this warrant iron at this time has certainly lessened the chances of makers selling their iron at the prices which they are asking, especially in any large quantities. It is possible that certain of this warrant iron is being offered in other territory at a less figure than $22 per ton at the furnace. The Birmingham district pig iron producers do not look upon the present lull with any degree of alarm by reason of their excellent condition of bookings.

Shipping Board

Is Named by President Wilson—Lake Region Ignored

Washington, Dec. 26.—It is presumed that shortly after congress reconvenes on Jan. 2, the senate will take up for consideration the matter of confirming the names of the members of the shipping board, selected by President Wilson. They were sent to the senate only a few hours before congress adjourned last Friday, and it is not known whether there will be any opposition to the appointments. Aside from one member, Bernard N. Baker, but little is known here of the men whom the President has selected. It has been observed with considerable surprise that no one from the region of the Great Lakes was chosen, while one man from the middle west, Kansas City, Mo., was named. The board, as selected by the President, affords two representatives from the Atlantic seaboard, one each from the Pacific and gulf coasts, and one from the interior.

The appointments follow:

William Denman, Democrat, San Francisco, six-year term; Bernard N. Baker, Democrat, Baltimore, five-year term; John A. Donald, Democrat, New York City, four-year term; James B. White, Republican, Kansas City, three-year term, and Theodore Brent, Progressive Republican, New Orleans, two-year term.

With the appointments, the White House gave out a statement concerning each member. Mr. Denman, an admiralty lawyer, was chairman of the committee to investigate municipal corruption in San Francisco, in 1908, and has been prominent in a movement in California for the election of nonpartisan judges.

Mr. Baker is well known in the east as a former ship owner, and for 30 years was president of the Atlantic Transport line. He took an active part in advising Secretary McAdoo when the shipping bill was being framed and while it was before congress for passage. In addition to being a director of numerour commercial enterprises, Mr. Baker is trustee of Johns Hopkins University, chairman of the Maryland conservation commission, and a member of the national joint commission on conservation.

Mr. Donald, said to have had lifelong experience in the steamship business, is a native of Scotland, but became a citizen of the United States in 1890. After serving in the dry docking and painting business, he became engaged in the West India fruit trade as a ship owner.

Mr. White, a lumberman, is said to be especially well informed on export business. He was chairman of the executive committee of three successive congresses for the conservation of national resources, and was elected president of the congress in 1911.

Mr. Brent was assistant to the vice president of the Rock Island-Frisco railroad lines from 1906 to 1910, and his part in reshaping the traffic policy of these lines brought him in contact with lake and coastwise shipping.

Powers similar to those of the interstate commerce commission with regard to regulating railroad rates, are given to the shipping board with respect to the regulation of water traffic throughout the United States and in foreign commerce. The board will organize a shipping corporation, for which the secretary of the treasury is authorized to issue bonds not in excess of $50,000,000 to finance the company. The government is to hold at least 51 per cent of the stock, with 49 per cent for private interests.

(*For complete prices see page* 1326)

Very High Price

Is Paid for Low Phosphorus Iron for Export to Japan

New York, Dec. 27. (By wire.)—Eastern standard low phosphorus has sold at a new high price of over $55 furnace. A sale of 2,000 tons for export to Japan was closed on that basis. A Nova Scotia steelmaker inquired for 5,000 to 10,000 tons of bessemer pig iron.

Heavy locomotive buying continues. The French state railways have placed 100 and the Paris & Orleans 50 with the American Locomotive Co. The Wabash has placed 25 and the Maine Central nine, also with the American Locomotive Co.

The finance committee of the Steel Corporation has fixed 107 as the price at which 35,000 shares of common will be offered this year to employes. Last year, the price was 85.

Andrew Fletcher, president of W. & W. Fletcher, Hoboken manufacturers of marine engines, has been elected president of the American Locomotive Co., succeeding W. H. Marshall, resigned. Mr. Fletcher has been a director and member of the executive committee of the Locomotive company.

Construction work on the $7,000,000 plant of the Westinghouse Electric & Mfg. Co., at Essington, Pa., along the Delaware, for the manufacture of marine machinery and motive power is, it is understood, about to begin, as the final engineering contracts have been placed.

Ferro Market

Not Affected by Peace Talk and Prices Are Firm

New York, Dec. 26.—Ferro-manganese has not been affected by the peace developments of the past week or 10 days and the market is very firm. All the domestic makers now apparently are holding firmly to their recent advance to $175, delivered, and they are entering some lots especially for early shipment, on this price basis. English makers have very little metal to offer, before the second half of 1917 and for this reason they are not competitive factors in the current trade at their unchanged price of $164, seaboard, since most of the going business calls for nearby shipment. This demand for early delivery usually runs in small lots and no large tonnages now are in the market. A leading western Pennsylvania maker, however, is reported to have closed for 1,000 to 1,500 tons. Several thousand tons of export inquiry remains current.

Spiegeleisen continues scarce, especially for nearby delivery, and prices now seem established at a minimum of $55 to $60, furnace, for 20 per cent. Some domestic buying for the later deliveries of next year is going on, but the market is not active. The export inquiries total from 2,000 to 3,000 tons.

Talk of Advance

Pittsburgh, Dec. 26.—The market for ferro-alloys is unchanged in the Greater Pittsburgh district. Ferro-manganese is being held at from $160 to $165, seaboard, although some dealers are talking about advancing prices to $175. Spiegeleisen is being quoted at $55, furnace, by most concerns.

Line Pipe

In Heavy Tonnages is Inquired for—Order Books Filled

Pittsburgh, Dec. 26.—Except for scattering inquiries for heavy tonnages of line pipe, previously referred to in these columns, the market for tubular goods offers no news of interest this week. A builder of a gas line from the Oklahoma fields to Chicago has not closed for 100 miles of 8-inch pipe, involving about 17,000 tons, inquiries for which went out 10 days ago. Most mills have enough tonnage on hand to maintain present operating rates well through the first half of 1917. Deliveries of boiler tubes are deferred 12 months in some instances.

Wire Products

Are Quoted $5 Above Regular Schedule by Some Sellers

Pittsburgh, Dec. 26. — Several manufacturers of wire products are quoting about $5 a ton above prices adopted Nov. 24, when quotations were advanced $3 a ton all along the line to $3 a keg as the base price of nails. Some material has been sold at as high as $3.15 and $3.25 a keg for nails. Specifications against contracts are heavy and considerable new demand exists. It frequently is predicted that leading makers will advance prices about $3 a ton in the next fortnight.

Nuts, Bolts and Rivets

Pittsburgh, Dec. 26.—In consonance with the recent advance of $2 a ton in the price of steel bars, manufacturers of nuts and bolts have put up prices 5 per cent and above. Rivets continue to be held at 4.25c for structural rivets, the price adopted about 10 days ago. Demand is described as fairly heavy. Ship builders are specifying briskly and are offering premium prices for early deliveries.

(*For complete prices see page* 1326)

Shell Steel

Is Being Bought as Liberally as Possible, But It is Scarce

New York, Dec. 26.—Some of the domestic munition makers who recently have been inquiring for a total of about 400,000 tons of 5½ to 7¼-inch rounds and squares for 1917 delivery, have closed with makers in the Pittsburgh and Youngstown districts on requirements aggregating 100,000 to 150,000 tons. This is to cover definite shell contracts now in the possession of these buyers. It is understood a large part of the remaining inquiries which have included 100,000 tons for a manufacturer in the metropolitan district and 100,000 to 150,000 tons for an Ohio company, represent tentative matters in that the prospective buyers have been attempting to secure a protection on the steel precedent to closing any new shell contracts. This difficulty of getting steel apparently is restraining the placing in this country of new orders for finished shells by the belligerent governments, since the manufacturers are not willing to take on this business unless the required material is on hand.

There are reports that some of the entente powers have been closing new direct orders for shell steel. There is no doubt that they would buy additional tonnage if the mills were able to supply it, which as a rule, the latter are not. The market on large shell rounds continues around 4.50c, tidewater, for export, or delivered to the domestic manufacturers, equivalent to approximately 4.25c, mill.

Semi-Finished Strong

Pittsburgh, Dec. 26. — Manufacturers of semi-finished steel have been handicapped considerably this month by a shortage of natural gas. Open hearth furnaces at Clairton, Donora and Monessen, Pa., have been operating at greatly reduced rates, on account of inability to obtain fuel. Managers of many plants have been installing powdered coal equipment and oil is being used to a greater extent than previously. The gas shortage, it is conservatively estimated, has reduced production from 5 to 10 per cent in this district.

Billets and sheet bars are being held at $60 a ton and above. Some tonnage has sold at $65, but not enough activity has featured the market recently to enable one to obtain an accurate line on the price situation. Most consumers have fully covered requirements for the first quarter and some tonnage has been sold for delivery in the second quarter of next year. Wire rods are being held at as high as $75 a ton by some makers.

Bar Advance

Is Now Being Quoted by All Manufacturers

Chicago, Dec. 26.—An advance of $2 per ton on soft steel bars has been made by the leading interest, following the action by eastern mills a few days previous. Inasmuch as this maker is not in the market, the price is nominal and really means little to the market. The important independents which have refrained from selling into last half maintain their position and will not open their books until after the beginning of 1917.

Hard steel bars continue at 3c, Chicago, with good demand and a disinclination on the part of mills to book much tonnage for next year in view of the uncertain supply of rerolling rails. While winter has cut down demand for reinforcing bars in the north, inquiry for this material for use in the southwest is strong. Consumers of this material are seeking contracts for 1917 delivery, but find difficulty in placing them.

Hard Bars Advanced

Cleveland, Dec. 26.—The soft steel bar situation is strong, with specifications liberal. One Pennsylvania maker of hard steel bars has advanced to 3.25c, mill, but considerably lower than this has been quoted. Rerolling mills are having some difficulty in buying rails and some of them are not inclined to take on additional business at the present time.

Bars Advanced $2

Pittsburgh, Dec. 26. — The Carnegie Steel Co. on Dec. 20, as briefly reported by *The Iron Trade Review* a week ago, advanced steel bars $2 a ton to 3c for shipment at its convenience. That figure now is being quoted by all manufacturers in this district, except those in a position to offer tonnage for nearby delivery. Premium prices are being paid for prompt shipment. Demand for bars continues very heavy for shipment to domestic consumers. Agricultural implement interests have been active factors in the market, although not much tonnage has been purchased in this district for the manufacture of farm machinery.

Bar Iron Holds Strength

Chicago, Dec. 26.—Bar ironmakers find the situation in their product strong and demand continues steady. Automobile makers are seeking wrought iron to use in the place of steel in many instances where the substitution is possible. The quotation is 3c, Chicago mill, with some sales at 3.10c and rumors that some orders have been taken as high as 3.25c, though the latter are not verified.

Some makers are entirely out of the market and will not take further tonnage on any delivery at present.

Shafting May Advance

Pittsburgh, Dec. 26.—No change is noted in the situation for cold rolled steel shafting, although the 20 per cent off the list figure gradually is disappearing. Deliveries are described as more satisfactory. It is likely that quotations will be advanced about five points shortly after Jan. 1.

Hoops and Bands

Pittsburgh, Dec. 26. — The Carnegie Steel Co. now is asking 3.50c for hoops, on $5 a ton above the previously prevailing price. Steel bands have been put up $2 a ton to 3c, for delivery at the convenience of the mill. Specifications continue heavy, although new demand has fallen off slightly. Mills in a position to meet specifications for early shipment are having no difficulty obtaining from $5 to $10 a ton above prices quoted for delivery at the convenience of the maker.

Cold Rolled Strip Steel

Pittsburgh, Dec. 26.—Cold rolled strip steel is being held at 7c, base. Although mills have not formally opened books for second quarter shipment, they have enough tonnage on hand to maintain present operating rates until July 1. Specifications show no diminution and some new demand exists.

Waterworks Systems

William Champe, consulting engineer located in the Nasby building, Toledo, is at present at work on the plans for waterworks systems for the cities of Dundee, Mich., and Deshler, O. The equipment of the Dundee plant will consist of one deep well pump, a concrete reservoir, an elevated steel tank, 5 miles of cast iron mains, 38 hydrants, and a building for the power plant. It has not been decided whether a gas engine or electric motors will be used to furnish the power. An appropriation of $35,000 was made for this work. The Deshler plant will contain one deep well pump, a concrete reservoir, an elevated steel tank, 5 miles of cast iron mains, 4 hydrants and a building for the power plant. The bids on the equipment and the construction of this work will be received in about two months.

(*For complete prices see page* 1326)

Furnace Coke

For Prompt Delivery May Command $14 Before Week End

Pittsburgh, Dec. 26.—With only about 50 per cent of the men employed by Connellsville cokemakers, reporting for duty today, it frequently is predicted that blast furnace fuel will sell at $14 a ton before the end of the week. On Saturday, several anxious consumers offered to pay $12 a ton and some coke sold at that figure for spot shipment. Prices today are the highest recorded since the strike of miners in the anthracite coal regions about 13 years ago. The contract market is quiet. Foundry fuel for spot delivery is being held at $14 a ton, but is not active. *The Connellsville Courier* says production the week ending Dec. 16 was 375,501 tons, compared with 424,765 tons the week before.

Last Sales at $10

Cleveland, Dec. 26.—The foundry coke situation has improved very little and many foundries are in constant danger of being compelled to suspend operations on account of inability to obtain deliveries. For prompt delivery, coke was sold a few days ago at $10 per ton, and it is not probable that it could be purchased at that price today.

Toledo Company Banquets

The third annual banquet given by the Standard Steel Tube Co., of Toledo, to its employes was held in the Commerce Club Thursday evening, Dec. 21. President George B. Storer announced that the company would give life insurance policies to its factory employes as Christmas gifts. The policies range from $750 for employes under 20 years, and $1,000 for all other single men to $1,200 for married men. The company will pay all the premiums, amounting to nearly $4,000 a year. At the conclusion of the dinner, the employes presented President Storer a mahogany cellarette and silver service. Charles Schmull, superintendent, was presented a gold watch. H. B. Chase, secretary and treasurer, made the presentation speeches.

The Novo Engine Co., Lansing, Mich., announces that its directors have voted the second annual wage dividend, covering 1916. All employes working throughout the year will receive 5 per cent of the annual wage total, while those employed between six and 12 months will receive 2½ per cent. The wage dividend is payable March 1 to all then in the employ of the company.

New Awards

Are More Numerous in Chicago—Few in the East

Chicago, Dec. 26.—Somewhat better lettings of structural material have been made recently than have been the rule this fall and winter. The Strobel Steel Construction Co., of Chicago, has taken 2,230 tons of material for repairs on the bridge of the New Haven railroad at Poughkeepsie. Another large tonnage closed recently is 1,849 tons of bridge material for the Burlington railroad, which was taken by the American Bridge Co.

The advance of $2 per ton in structurals by eastern mills has been followed by western makers as a matter of form, as none has any material for sale at this time.

Shapes Held at 3.10c

Pittsburgh, Dec. 26. — The Carnegie Steel Co. and other manufacturers of structural shapes now are quoting 3.10c, the price adopted Dec. 20 by the Carnegie company. Specifications against contracts are heavy, but new buying is light, as might be expected at this time of the year. Fabricating shops are being operated at maximum capacity and many of them are buying material from warehouses, in order to meet specifications for delivery.

Deliveries Delayed

Buffalo, Dec. 26.—Consumers of the district report that the severe weather conditions, plus car shortages and embargoes, are making it extremely difficult to secure anything like required shipments of material under contract. Many consignments on the road for three and four weeks are still undelivered, where under normal conditions the normal time required to effect deliveries would not exceed three to four days. Structural shapes are now being quoted by most mills and agencies at an advance of $2 per ton over previous prevailing prices, or at 3.10c, base. Prices at best are but nominal and few transactions are being recorded owing to the unwillingness of producers to take on additional tonnage at the present market basis and also to a somewhat more conservative attitude on the part of some buyers.

One interest has booked a few orders for delivery in second quarter, but has displayed no disposition to open its books for more business at present prices.

Ahead of Normal

New York, Dec. 26.—Holiday quietness is on the structural market in this territory and new awards and inquiries have been few. Leading fabricators state, however, the tonnage for the season is considerably ahead of normal. New York City still has a considerable tonnage of subway work to place for extensions in Brooklyn which, it is estimated, will require 25,000 tons or more. Early action on this matter is expected. Most of the independent makers of shapes now quote 3.25c, Pittsburgh, minimum, or 3.419c, New York, representing $3 above the new 3.10c, Pittsburgh, quotation of the leading interest. Some makers are holding for 3.50c, Pittsburgh, but are selling little on this basis.

CONTRACTS AWARDED.

New Haven Railroad Co., Poughkeepsie bridge over Hudson river at Poughkeepsie, New York, 2,230 tons, to Strobel Steel Construction Co.

Burlington Railroad Co., bridge material, location unknown, 1,849 tons, to American Bridge Co.

Schaefer Bros., Crystal theater building at North Avenue and Washtenaw street, Chicago, to Jennet Bridge Co.

Armour & Co., oleo building at Sioux City 403 tons, to Christopher & Simpson.

James Stewart & Co., sugar factory at Moroni, Utah (owners unknown), 313 tons.

Kawneer Mfg. Co., factory building at Niles, Mich., 272 tons, to International Steel & Iron Works, Evansville, Ind.

Union Sand & Material Co., material for Tyler street plant at St. Louis, Mo., 132 tons to Missouri Bridge & Iron Co.

Steel work for subway under City Hall, Philadelphia, 900 tons, to be supplied by the American Bridge Co. under reawarded general contract.

Nurses' home, Philadelphia, 300 tons, to the American Bridge Co.

Death of Wm. E. Leard

William E. Leard, of New Brighton, Pa., died at Southern Pines, N. C., on Dec. 17, following a long period of illness. Mr. Leard was born at Livermore, Pa., 74 years ago and was in Company "M", 102 Pennsylvania Volunteers, during the civil war. Shortly after the war he engaged in the manufacture of drill presses in Cincinnati. In 1882 he located a plant in New Brighton, Pa., for the manufacture of connecting rods, strap joints, crankshafts and machine keys, and was in active charge of the plant until within the last eight years.

Frank D. Blake, manager of publicity for Deere & Co., Moline, Ill., died at his home in that city Dec. 21 of ptomaine poisoning. He had been a cowboy, newspaper reporter, editor, advertising salesman and publicity expert. He formerly was with the Rock Island Plow Co., entering the service of Deere & Co. in 1907.

(*For complete prices see page* 1326)

Sheet Production

Is Curtailed in the Valley—Prices Are Unchanged

Youngstown, Dec. 27.—Sheet production in the Mahoning valley is limping over the holidays; prices remain about as they were last week.

Some of the finishing mills have shut down and others have cut their running time still further. None of them was on full time just before Christmas; this week some of them are operating at not more than 25 per cent of their capacity.

Black sheets, for prompt shipment, or as prompt as possible, are selling at from 5c to 5.50c, with an occasional small order at a shade higher; blue annealed is holding at about 4.75c; galvanized brings from 7c to 7.50c, notwithstanding lower prices quoted in other sheet producing territories.

Shutdowns and further curtailment of production are expected to loosen up the car situation in the valley, and improvement is expected next week.

Prompt Sheets High

Pittsburgh, Dec. 26. — With virtually every mill in the district out of the market for shipment before July 1, consumers of steel sheets are paying decidedly high prices for anything like nearby delivery. Bessemer black sheets, in some instances, have commanded as high as 5.50c for No. 28 gage and blue annealed products are being quoted at as high as 4.75c, base. Black sheets are selling at a range from 4.50c to 5.50c and blue annealed products, from 4.25c to 4.75c. Recent fluctuations in the price of spelter have not affected the market for galvanized stock. Coated material is commanding from 6.50c to 7.50c. Only about 44 per cent of the galvanizing pots owned by manufacturers of steel sheets are in operation. Consumers are endeavoring to cover requirements for the third quarter of 1917, but no tonnage has been sold for delivery after July 1, so far as can be learned. The American Sheet & Tin Plate Co. now is quoting blue annealed sheets at 4c for No. 16 gage and heavier.

Buying Small

Chicago, Dec. 26.—Buying of steel sheets is small on account of high prices and difficulty of placing contracts with makers. Blue annealed, No. 10 gage, have been sold as high as 4.50c to 5c, with galvanized at 6.50c to 7c, and No. 28 gage black at 5.50c.

The Toledo Ice & Coal Co., Toledo, O., will erect a new factory of brick, which will cost $51,895.

Car Awards

Made Last Week Total About 4,000—Foreign Demand Continues

New York, Dec. 26.—No cessation is to be noted in car buying activity in the face of the prevailing uncertainties, and both domestic and foreign roads continue to bring out new inquiries and to negotiate for large blocks. The Russian government railways, which placed 3,000 cars last week, still are in the market for a large number which, it is estimated, may be upwards of 20,000. The French railways also are figuring on a large number. New car awards made during the past week total about 4,000. They include 1,000 box and 500 auto for the Northern Pacific to the Pressed Steel Car Co.; 500 hoppers for the Wheeling & Lake Erie, to the Pressed Steel Car Co., and 500 gondolas for the same road to the Standard Steel Car Co.; 750 hoppers for the Nickel Plate to the Standard Steel Car Co., and six passenger types for the Boston & Maine to the Standard Steel Car Co. The Great Northern will build 500 stock cars in its own shops. New inquiries include 500 gondolas and 500 refrigerators for the Northern Pacific; 100 gondolas for the Piedmont Northern; 200 hoppers for the Atlantic Coast line; 100 hoppers and 100 box for the Long Island; 25 to 35 subway cars for the Boston Elevated; 10 express for the Lackawanna; 15 express and five combination for the Atlantic Coast line.

No distribution of its 205,000-ton rail order for 1918 yet has been made by the Pennsylvania railroad. Rail buying is quieter and most of the mills show no disposition to push sales for 1918 delivery at $40, mill, leaving it to the railroads to bring forth their requirements as they are disposed. Considerable new export inquiry is coming out regularly, including a new lot of 35,000 tons for Russia. The St. Paul railroad has placed 20,000 tons of rails additional for 1918 delivery with the Illinois Steel Co.

Rail Selling Continues

Chicago, Dec. 26.—Contracts for standard steel rails for 1918 delivery continue to be closed and sales in the past week in the west aggregate about 25,000 tons, most of this being for electric lines which are coming to be an important factor in the rail market. Some large inquiries are still under consideration, including that of the Pennsylvania railroad for 205,000 tons.

Light rails continue unchanged in this market, although in the east decided advances have been made. It is believed a change upward will be made in a short time, as the spread now is unusually wide.

Rails for Trench Service

Cleveland, Dec. 26.—An inquiry for from 5,000 to 6,000 tons of light rails, 19.2 pounds per yard, cut in 5 meter lengths for trench service in France, has been received, and also an inquiry for from 4,000 to 5,000 tons of flats which are used for ties in this kind of track construction. It is understood that mills will quote about $10 per ton higher on this material than they did on similar material five or six weeks ago.

Rails and Track Equipment

Pittsburgh, Dec. 26.—Makers have sold enough tonnage to indicate that railroad spikes have been established at 3.40c, the price adopted several weeks ago. One consumer has bought about 2,000 kegs of standard spikes at that figure. Mills are asking 3.50c Chicago, for standard sizes.

Scrap Low in East

Philadelphia, Dec. 26. — Lower prices have appeared in some grades of old material in a market of quiet and scattered trading. Heavy melting steel, shafting, wrought pipe and old car wheels are among the grades affected. Embargoes are figuring in the situation as well as peace reports. Coatesville, where one consumer recently bought heavy melting steel at $25, delivered, is completely embargoed. There are embargoes also at Harrisburg and Chester. The new car service regulations now in effect which increase the demurrage charges is causing consumers to keep shipments to a minimum. Heavy steel has been offered to the mills this week at $24, delivered, and has been declined. Rerolling rails were sold at $30, delivered, for a few cars and $32, delivered, is offered by buyers on tonnages.

Handsome Dividend

Buffalo, Dec. 26.—The Buffalo Copper & Brass Rolling Mill presented to the holders of preferred stock in the company a Christmas present dividend amounting to 42 per cent, in deferred dividends on the stock. The total issue of preferred stock of the company is about $400,000, making the dividend distribution total about $168,000.

The dividend distribution covered the regular 6 per cent dividend on the preferred stock which had been deferred for seven years. The distribution just made clears up the cumulative dividends on the preferred stock of the Buffalo Copper & Brass Rolling Mill to Aug. 1, 1916.

(For complete prices see page 1326)

Hear Arguments

In the Eastern Export Iron and Steel Case

Washington, Dec. 26.—The interstate commerce commission heard arguments last Saturday in the eastern export iron and steel case. The protests against the plan of the carriers to withdraw prevailing export rates through Atlantic and Gulf ports and to substitute domestic rates were aimed principally against the relationship that would be brought about through the readjustment, rather than against the rates themselves, which would represent increases ranging from 30 to 50 per cent.

George Stuart Patterson, general counsel for the Pennsylvania railroad, appearing for all of the carriers, made the specific announcement that the railroads had promised to restore the present export rates, if, with the return of normal conditions, this was found to be necessary. Some of the steel producers, apparently, felt that the railroads would not make such a direct promise, although in a general way they had made this proposal.

The principal protestant was the Pollak Iron & Steel Co., with mills at Chicago and Cincinnati, represented at the arguments by Allan R. Campbell, and Francis B. James, and the Whitaker - Glessner Co., and the Ironton-Ashland Manufacturers' Association, represented by A. E. Singleton. Mr. James said that, predicated upon the relations that exist between rates from Pittsburgh to Chicago, the latter city should be given a rate of 28.1c per 100 pounds to New York, instead of 31.5c, and that Cincinnati should be given a rate of 24.2c, instead of 27.4c. Mr. Singleton, arguing along the same line, said that Portsmouth, O., should be given a rate of 22.3c, instead of 24.3c. The protestants said the readjustment would result in a discrimination against the points named in favor of producing points.

One stack at the Central Works of the American Steel & Wire Co., at Cleveland, is banked, and also the Emma furnace at Newburg. A week ago, the Emma stack was running, but there were two stacks banked at the Central Works. The situation is about the same. The company does not expect to bank any more stacks at present. All other Cleveland stacks are in operation.

The Owens Bottle Machine Co., of Toledo, O., distributed $51,000 among its employes as a Christmas present. Those who have been in the employ of the company one year or more received a bonus equal to 10 per cent of their yearly wages.

Tin Plate Price

Now Ranges from $7.50 to $8—Talk About Last Half Price

Pittsburgh, Dec. 26.—Consumers of tin plate are urging manufacturers to open books for delivery after July 1, next. Indications are that mills will refuse to sell for shipment beyond Oct. 1. When books were opened for delivery the first half of the year, manufacturers quoted from $5.75 to $6, base; material for shipment the third quarter of next year will command from $7 to $7.50, base, according to frequent suggestions. Scarcely any new tonnage is available for delivery the first or second quarter. Tin plate nominally is quoted at a range from $7.50 to $8, base. The American Sheet & Tin Plate Co. now is quoting tin plate at $7, base, for shipment before July 1. The company, however, virtually has no tonnage to offer for first or second quarter delivery.

Warehouse Prices

Have Been Advanced at Buffalo, Cleveland and Chicago

Buffalo, Dec. 26.—Warehouse prices on bars, shapes and plates have again been advanced in this district to the extent of $2 per ton on bars and shapes and $5 per ton on plates. Bars in small sizes are being quoted now at 3.85c, while bars, 2 inches and over, are up to 4.50c; structural is quoted at 3.95c, and plates at 4.60c, while hoops have advanced to 4.75c.

Advance at Pittsburgh

Pittsburgh, Dec. 26.—In consonance with recent advances of $5 a ton in the price of plates and $2 a ton each in prices of shapes and bars, warehouse managers have announced similar advances in quotations. Warehouses now are quoting plates at 4.50c; shapes, 3.85c; bars, including flats, rounds and squares, under 2 inches, 3.75c; over 2 inches, 4.40c. Deferred mill deliveries continue to embarrass warehouse managers, who are unable to replenish stocks. Demand is described as heavy. Many of the smaller consumers are obtaining fully 50 per cent of their requirements direct from warehouses.

Stores Advance Sheets

Chicago, Dec. 26.—Chicago warehouses have advanced steel sheets sharply to keep up with mill prices, which are on the highest level yet attained. No. 10 blue annealed have been advanced from 4.25c to 4.50c, No. 28 black from 4.75c to 5c and No. 28 galvanized from 6.75c to 7c.

Plates, shapes and bars remain at the same level, though an advance of $2 has been made by mills during the past week. It is understood eastern stores have followed this increase and it may come here later.

Warehouse Prices Marked Up

Cleveland, Dec. 26.—Shapes and bars have been advanced $2 per ton and plates and hoops $5 per ton and quotations now are: Bars under 2 inches, 3.85c; shapes, 3.95c; plates, 4.60c; hoops, 4.75c. Warehouse business continues very active, limited only by ability of warehouse to replenish their stocks.

Coke Shortage

Is Causing Serious Trouble in Eastern Pennsylvania

Philadelphia, Dec. 26.—Operating problems continue to command the first attention of pig ironmakers and some of the consumers as well in this district. Further banking of furnaces has been forced by coke shortages, including one Thomas stack. A number of other furnaces are running on the ragged edge. A complete railroad embargo on all manufacturing materials including pig iron has been imposed at Coatesville. Under these conditions, prompt iron is arousing more interest while the new buying for forward shipment, such as the last half of 1917, is light, due to the peace talk.

The belief is held in well informed circles that buying for nearby will supersede forward covering during the prevailing uncertainties. Prices are being well maintained by the furnaces. A Coatesville, Pa., steelmaker who has been buying prompt basic because his stocks are reduced, as stated in these reports a week ago, has made further purchases in the week. The total of prompt basic bought now is 17,000 tons, and the prices have ranged from $30, delivered, to $30, furnace, to approximately $30.40 to $30.75, delivered.

This steelmaker has been buying prompt metal notwithstanding he had been fully covered on first half contracts. Another steelmaker will furnish from stock part of the iron bought.

Forward No. 2X is from $29.50 to $30.50, Philadelphia. Virginia is unchanged at $26 to $28, furnace, for No. 2X. A sale of Virginia warrants at $24.75, furnace, is noted. There is some new foundry iron inquiry which generally is light. One buyer asks 1,800 tons for first half. A Birdsboro iron mill recently bought 1,000 tons of gray forge.

(*For complete prices see page* 1326)

Plates Strong

Railroad Buying a Factor of Growing Importance

Pittsburgh, Dec. 26. — The advanced prices of plates, shapes and bars, announced Dec. 20 by the Carnegie Steel Co., and published in *The Iron Trade Review* last week, failed to cause any comment among consumers. They appear to be interested only in the shipment of material purchased some time ago. Steel plates now are being held at 3.60c by the Carnegie company and the Jones & Laughlin Steel Co. for delivery at their convenience. No large orders for plate have been placed in this district this week.

Further peace talk last week tended to check activity for a few days, and mill managers appeared apprehensive about the future. The market, however, already has recovered its previous position, although it is not so excited as it was 30 days ago, much to the satisfaction of many steel producers. Since mills some time ago disposed of the bulk of their output for delivery the first six or eight months of 1917, it is not surprising that new buying is light.

Market Very Strong

Cleveland, Dec. 26.—The plate market does not show the slightest indication of weakness on account of the recent agitation in regard to peace. Railroad buying has increased, as the railroads are showing a determination to get the rolling stock which they sorely need and car builders are placing contracts freely to cover recent orders for cars. The Carnegie Steel Co. will furnish 700 tons of shapes, plates and bars for the superstructure of the floating pontoon crane to be erected by the Wellman-Seaver-Morgan Co. for the government at Mare Island navy yard.

Prices Higher

Chicago, Dec. 26.—Although no plate mills in this district are in the market at present, demand continues. Quotations have been increased $2 per ton, to 2.79c, Chicago, a purely nominal figure under the circumstances, and made simply to follow eastern mills. The leading independent maker of plates has some capacity unsold for last half of 1917 which will be opened in a short time. Sufficient business to absorb this at almost any price is standing ready to make contracts as soon as they will be entertained. Just what price will be realized on this business is interesting to conjecture. Some 1917 plates were sold earlier this year in Chicago at 4.19c.

Scrap Prices Very Weak

Quotations Recede at Pittsburgh and Other Centers and Market is Extremely Dull

Pittsburgh, Dec. 26.—Prices of iron and steel scrap in this district have receded all along the line. Although many people attribute the general decline to talk of peace, it is not unusual for prices of scrap to fall off, after advancing rapidly. Heavy melting stock, held at $28 a ton a fortnight ago, now is quoted at about $24 and other grades are proportionately weaker than previously. New demand is light and not much tonnage is being sold at reduced quotations. Dealers believe prices will advance sharply just as soon as moderate demand is enjoyed.

Unsettled Conditions

New York, Dec. 26.—An unsettled condition prevails in the scrap market in view of the current uncertainties and the undertone shows the easiness which normally would be expected. There is no selling except in small lots and prices, though they are quoted unchanged, are altogether nominal in the absence of transactions. Buyers will not make offers at present, except those several dollars under the prevailing market, which are not taken seriously. One eastern Pennsylvania mill, for instance, has offered $20, delivered, for heavy melting steel, as against last sales of $24 to $24.50, delivered. Consumers in the Pittsburgh district have been offering $24, delivered, or $3 under previous prices.

Heavy Melting Scarce

Buffalo, Dec. 26.—There are a number of large inquiries in the market for heavy melting steel for delivery over first quarter of the new year, but there is an absolute shortage of this line, and while prices have not changed in the past week, the indications point to further advances.

The volume of business of the yards of the district during the past week reflected the customary holiday lull and this situation was intensified by the severe weather conditions. Shipments have been held up owing to the shortage of cars and labor as well as due to the recent storm.

Halts in South

Birmingham, Ala., Dec. 26.—In sympathy with the pig iron market, old material has experienced a halt in prices as well as demand by the larger users. However, there are many of the smaller foundries in the south which continue to buy good machinery scrap in preference to the lower grades of pig iron. Dealers claim that the let-up in demand has not inconvenienced them in the least owing to their demoralized condition previous to peace talk.

Extremely Dull

Cleveland, Dec. 26.—The scrap market in this territory is in the doldrums. Prices remain about as they were just before Christmas; but there are practically no buyers at any price. Most of the quotations on the principal items in the old material market are nominal.

Some of the leading dealers who had gone out of town over the holidays did not trouble to return to their desks the morning after Christmas. They had no confidence that the market would be enlivened at once after its pre-holiday slump, and their hunch was justified.

For lack of any basis for a different quotation, heavy melting steel stands at from $23 to $24, and the other units as they were quoted last week.

Some Decline in Scrap

Chicago, Dec. 26.—The downward tendency in scrap observed a week ago has continued, though quotations have not receded markedly after the first drop. Losses of 50 cents to $3 per ton have been registered. A number of large dealers have been selling and have created a strong short interest which believes prices will regain their former level in a short time. This belief on the part of large sellers is interesting to note. Buying for actual use has been resumed after a lull of a few days and the market is in excellent condition except that the level of prices is lower.

Sharp Declines

St. Louis, Dec. 26.—The unsettled conditions of the scrap market in this locality continues and all grades are seeking lower levels. On some grades there have been sharp declines, even as much as $3 a ton. The fact that the largest consumers are strictly out of the market for the present has caused brokers and dealers to dispose of their holdings at ridiculously low prices, which completely unsettled the market. The present situation probably will not last much longer, as consumers in general are short of stocks and dealers are of the opinion that prices will advance soon to recent high levels.

The only offerings before the market this week are: Chicago, Burlington & Quincy railroad, 2,000 tons; Chicago & Eastern Illinois railroad, 550 tons.

(*For complete prices see page* 1326)

Cast Iron Pipe

Shows Seasonable Dullness—Specials in Demand

New York, Dec. 26.—Buying of cast iron pipe by the water and gas companies, though quieter, as is usually the case at this season of the year, has been considerably ahead of the corresponding period last year and apparently, has been little affected by the peace discussion. The eastern market is not active but is following the usual situation expected at this time. Public inquiries also are few. The Boston inquiry for 2,600 tons was bid upon Dec. 26. Holyoke, Mass., this week took figures on 200 tons. Export inquiry still appears, but there are few sales being made because of scarcity of ships. Prices are holding very firmly at their recent advances.

Pipe Specials in Demand

Chicago, Dec. 26. While inquiry and orders for cast iron pipe are small at this time and cities are not buying heavily for their extensions next year, industrial concerns are taking large quantities of special castings. Mining, oil and chemical industries are expanding and require much in the way of special apparatus and fittings which are produced in pipe foundries. This tonnage makes up in large measure for the slack business in pipe.

Figures were opened last week at St. Paul on 1,500 tons of pipe, but no decision has been made on the award. Bids will be opened Dec. 28 at Sioux City, Ia., on 1,500 tons; at Madison, Wis., Jan. 5, on 375 tons, and at Ft. Wayne, Ind., Jan. 9, on 300 tons.

No Improvement.

Birmingham, Ala., Dec. 26.—The cast iron pipe market has shown no improvement over the week previous, and one of the largest producers has reiterated his former statement to the effect that they are not hoping for improved conditions under present high prices. Under present conditions, the plants will be able to give their men a much needed rest during the holidays.

Schwab Says He Plans for Peace

Is Preparing to Meet Needs of His Own Country and Would Regard Ending of the War as a Blessing—Notable Speech in New York

SPEAKING at a dinner given in his honor by the Lotus Club of New York, Thursday evening, Dec. 21, Chas. M. Schwab predicted that the United States producing 40,000,000 tons of steel today was as far from its zenith as it was in 1901, when its output was 12,000,000 tons. Mr. Schwab's predictions regarding the steel trade have attracted much attention and this statement was regarded as expressing his belief that the next 15 years would show another remarkable expansion of the country's premier industry during which the trebling of its output will be within the range of possibilities. He spoke optimistically of the outlook for the steel industry of the country and stated that though permanent peace would bring its adjustments to trade, this, in time, should prove a boon rather than a deterrent to prosperity. By way of practical suggestions to insure prosperity, he proposed that measures be taken to encourage American ship building, one of which proposes that American ships should have lower tolls through the Panama canal than foreign vessels. He predicted a great expansion of American ship building if the government would render this industry due support.

Mr. Schwab told in general terms of the phenomenal rise of the Bethlehem Steel Corporation in recent years and of the plans for the extensions of its plants on a large scale. He spoke of the relations of his company with the government and of the repeated offers he had made to the latter to furnish it with armor plate and ordnance at a price determined to be reasonable by the experts of the purchaser.

At the conclusion of Mr. Schwab's address, Judge Alton B. Parker proposed that Mr. Schwab be named for secretary of war and this statement met with an outbreak of enthusiastic applause from the diners.

President Eugene G. Grace of the company also spoke at the dinner and gave some intimate and entertaining facts regarding Mr. Schwab's career as head of the Bethlehem Steel Corporation.

Mr. Schwab's address in large part follows:

You must pardon me if I speak of concrete things and if those concrete things revolve around the chief interest in my business life—Bethlehem Steel.

Though Bethlehem has prospered, the fact about Bethlehem in which I most keenly rejoice is that whereas in 1915 we employed 23,000 men, in 1916, some 70,000 men are on our payrolls now.

In 1915 our total payroll was $22,500,000; in 1916, it is at the rate of $72,000,000 a year, or $6,000,000 a month.

The average earnings of each wage-earner in our employ were a little over $900 per man in 1915, whereas our figures for 1916 show average earnings of nearly $1,200 per man, an increase of more than 30 per cent.

These large earnings have been realized because 1916, it is now at the rate of $72,000,000 a year, in every case possible the man obtained a share of the profits which he helped create. And that is one of the reasons why our men have not only been prosperous, but enthusiastic in their work.

The labor problem is far from being solved, but if the managers of industry can develop some universal plan which will make labor not only well paid but happy in doing the work itself, one of the greatest possible boons to mankind will have been realized.

Schwab Never Received Bonus

(From Mr. Grace's Speech.)

The facts are that while other officers have received bonuses on profits they helped make, Mr. Schwab himself has never received any bonus whatsoever. During many of the years he had worked hardest for the company—years, in some of which the company could not borrow money unless Mr. Schwab personally endorsed its paper—he had declined to accept any salary.

These stockholders also found that Mr. Schwab, though himself the largest shareholder, had for 10 years or more kept pouring the earnings back into the property, denying himself any return on the large investment he had made. It is for such reasons as these that the phenomenal action of Bethlehem in the stock market was not merely pyrotechnics; it was only belated reflection of the meaning of a policy of men-building and of property-building as magnificent as anything in the history of American industry.

Mr. Schwab indeed builded better than he knew. But he built upon enduring foundations, foundations which we believe will prove bulwarks of prosperity in the strenuous years which American industry is now facing.

Though it would be inappropriate for me to discuss the commercial interests of Bethlehem generally, I think I can say something of our relations with the United States government, for in a peculiar sense Bethlehem serves the American people by providing so large a quantity of ordnance materials for the use of its army and navy.

We at Bethlehem have felt great satisfaction during the last two and a half years at our affairs having been placed upon such a basis that in spite of the great increases in the costs of all materials, we were able to supply all ordnance products to the United States government at exactly the prices prevailing before the war in Europe began. We have felt that this was something worth doing for its own sake.

Again, we felt that it would be a mistake for the United States government to undertake the building of a federal armor plant. Some officers of the government said that we had charged them too much. We did not concede that, but we were willing to waive debate on the point and offered to make armor for the government at any price the government itself might consider reasonable.

At the present time, our navy is being rebuilt and enlarged. Greater ships are to be constructed and larger guns will be used than ever before in the history of the country.

Realizing the need, we have already undertaken out of the profits derived from other business, to construct at a cost of $4,500,000 a plant fitted to build 16-inch guns, the plant to be of use for no other purpose. We have received no assurances from the navy department, and under no conceivable conditions can the orders which we may receive for this plant pay a fair return on the investment. But we felt that we must do this to play our part in protecting the nation. It was something worth doing for its own sake.

Inquiries are sometimes made as to whether it may be necessary for the government to build plants to supply the nation with munitions of war which may be required for its preparedness program. We have said to the government that our ordnance plants are at its disposal at a fair operating cost, plus a small margin, thus saving the government the cost of the investment and the cost of depreciation—items which we have already amortized. This again is something we feel is worth doing for its own sake.

This is a time for great vision, for study and preparation. No man can foresee the problems with which the United States is face to face. We have one-twentieth of the populatin of the world and one-third of its tangible wealth. When peace comes, all other nations will contest with us the trade supremacy of the world.

Many methods will be suggested by which we may retain our present position and make it more secure. But I desire to make a concrete suggestion.

I am a ship builder. The Bethlehem Steel Corporation is building fully one-third of all the ships now under construction in this country. We are completing every week one 10,000-ton merchant ship fully equipped, besides battleships, submarines and smaller vessels.

But we must note these striking facts:

More than one-half of all the ships building in the United States today are for foreign owners. Statistics show that the American merchant marine on June 30, 1914, amounted to 2,027,000 gross tons, and on June 30, 1916, it is credited with 2,853,000 gross tons, an increase of 826,000 gross tons. But this growth is not all due to new building; 622,000 gross tons was due to the transfer of foreign vessels (mostly American owned) to American registry. The increase due to building is only 204,000 gross tons.

Of course, so long as the war lasts and the United States remains neutral, nothing will prevent a tremendous increase in the American merchant marine. The real point, however, is that if present dues, wages and other restrictions upon vessels flying the American flag prevail after the war, American owners will again transfer their vessels to foreign registry.

Successful ship operating is dependent wholly on the ability of American registered ships to compete with foreign bottoms. When the wage item alone, under American registry, costs, under ordinary conditions, in the neighborhood of 40 per cent more than British or Norwegian owned vessels, it is not difficult to see the outcome of the competition.

Makes a Suggestion

To meet this situation, I suggest as one step in advance—that ships flying the American flag be permitted to go through the Panama canal at lower tolls than foreign ships. The Panama canal is destined to play a larger and larger part in American commerce and such a plan would assist American ships to maintain the American standard of wages, and thus be the better able to take care of themselves in world competition. We built the Panama canal; why not let American trade benefit by it?

I am an optimist. Some see disaster if peace come, but I look upon peace as a blessing and I should rejoice in it if it came. But we all want a conclusive peace, and not a peace which merely presages another war.

Bethlehem Steel has planned a building and construction program involving an outlay over the next few years of about $100,000,000. This constitutes, I believe, the largest single construction undertaking ever entered upon by a single industrial corporation.

Bethlehem Steel activities up to now have been mainly in the production of ordnance products and munitions. But we are planning for peace. We want Bethlehem to be an efficient ordnance making plant, sufficiently large to serve the needs of our own country, for Europe will no longer need us.

So when our plan of improvements is completed, the 25 component parts of Bethlehem Steel will consist of only one part ordnance making, four parts ship building and 20 parts the manufacture of steel for commercial purposes. Bethlehem will have ceased to be primarily an ordnance-making corporation. Profits of war will have been turned into implements of peace.

We have undertaken this gigantic program at a time when the costs of making everything have gone beyond all previous bounds. Many of our friends have urged us to go slowly and wait until the costs of building plants and increasing facilities are reduced. But we believe that when facilities are needed, they ought to be provided, and that builders should not speculate upon what they may be able to do in the future. They should do it now.

When the war is over, there will of necessity be a reduction in the demand for munition steel, and there will be some recession in steel prices generally. But the domestic demands for steel rails, for building and for numerous other purposes await only a more normal condition of trade to press forward for prompt satisfaction. Those domestic demands alone will absorb our steel capacity for many years.

A period of depression will come sometime and it may be severe, but it will not become acute, in my judgment, until at least three to five years after the war is ended.

This country cannot stand still. The United States produced only 1,000,000 tons of steel in 1880, while this year 40,000,000 tons have been produced. When the United States Steel Corporation was formed, 15 years ago, the annual steel production of the country was only 12,000,000 tons and many believed we were then at the zenith of the steel business.

My own belief is that we are just as far from the zenith today as we were in 1901.

Salaries Raised

The Youngstown Sheet & Tube Co. Saturday last announced a wage increase for its salaried employes and officials of 10 per cent, the advance coming in the nature of a Christmas present. An increase to all mill employes earning under $2,000 a year took effect Dec. 15. It is stated that this corporation intends to construct another tube mill in the spring, the foundations have been completed before the coming of freezing weather. At the present time the concern has six butt-weld and six lap-weld mills, the addition to be known as No. 11.

W. H. Foster, president of the General Fireproofing Co., Youngstown, O., announces that the matter of increasing the capital stock is to be taken up at the annual meeting Feb. 23, if not sooner. The corporation has enjoyed an exceedingly prosperous year, recently declaring a dividend of 40 per cent on the common stock.

Three Stacks Banked

Youngstown, Dec. 26. — Probably the most important event in Youngstown manufacturing circles during the past week was the banking of three Carnegie bessemer stacks at the Ohio works, because of a scarcity of coke, due to the inability of the railroads to make deliveries. The fuel situation was reported bad at the beginning of this week at all of the steel mills, the snow storms only making worse the handling of freight on the congested lines entering Youngstown. It was about two weeks ago that the Carnegie Steel Co. was compelled to close down its Niles, O., furnace because of the coke shortage.

The Pittsburgh Meter Co. secured the contract for furnishing the large sized water meters for the waterworks department of the city of Toledo on its bid of $5,400.

The East Chicago Foundry Co., East Chicago, Ind., has established a plant at 148th and Railroad avenues for the manufacture of gray iron castings.

Plans for the merging of the Economy Motor Car Co., of Tiffin, O., with the Bellefontaine Automobile Co., are going forward. The combined factory is to be located at Bellefontaine, O.

New buildings and tanks to cost about $75,000 will be erected by the Standard Oil Co., at Tiffin, O., within the next few months. These improvements will almost double the size of the plant.

The Willys-Overland Co., of Toledo, entertained 8,600 dealers between December 4 and 21, with the result that 199,850 automobiles, with a valuation of $169,872,470, were contracted for by the visiting agents.

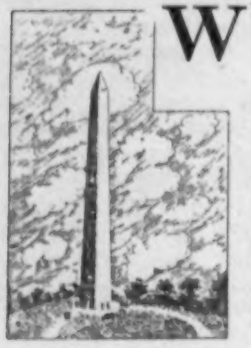
In view of a prosperous year and the removal to its new home on Spencer street, the Haughton Elevator & Machine Co., Toledo, distributed $5,000 among its 250 employes a day before Christmas.

A meeting of the stockholders of the Fostoria Light Car Co., of Fostoria, O., has been arranged for the afternoon of Jan. 8, 1917. The election of new officers and the reorganization of the company will take place. The name of the company will be changed to the Seneca Motorcar Co.

Business News of Nation's Capital

Council of National Defense Starts Work—Awarding of Contracts for Battleship Cruisers is Delayed—The Treasury Deficit

Bureau of *The Iron Trade Review*,
708 Metropolitan Bank Bldg.,
Washington, Dec. 26, 1916.



WITH Dr. Hollis Godfrey, of Philadelphia, selected as chairman of the advisory commission of the council of national defense, offices have been obtained at room 918 Munsey building, this city, a staff installed and set to work.

Preliminary work under the direction of the council and the advisory commission will be conducted by a temporary director and temporary secretary of the advisory commission. W. S. Gifford, chief statistician of the American Telephone & Telegraph Co., has been released for the present from his duties by permission of President Theodore Vail of the company to act as temporary director. D. Dana Bartlett, consulting engineer, New York City, was selected as temporary secretary.

Four groups of investigation and four chiefs of investigation were approved and the work authorized at a meeting of the council. These groups were, first, the work on medical preparedness under the direction of Dr. Frank F. Simpson, Pittsburgh, chief of investigation; second, the work on personal index and general inventory under the direction of Prof. Henry E. Crampton, Columbia University, chief of investigation; third, the work of the industrial committee of the naval consulting board under the direction of the temporary director of the work under the commission, Mr. Gifford; fourth, the work on the special inventory of industries and resources under the direction of Prof. Abraham Henwood, Drexel Institute, chief of investigation.

Armor Plate Plant

Washington, Dec. 26.—Indications are that considerable time will be required by the technical board named last week by Secretary of the Navy Daniels to conclude the investigation as to suitable sites for the proposed government owned armor plate plant. After making the investigation, the board is to report to Mr. Daniels, but the matter of approving the place or places for the plant or plants rests with the general board of the navy. The board selected by Mr. Daniels consists of Admiral Frank Fletcher, chairman; Commander Frank H. Clark, assigned to prepare plans for the plant, and Rubin B. Backenhaus, civil engineer of the Boston navy yard.

The board perhaps will not begin its work of actual investigation until after the new year. Its work will not be confined to the 22 towns which the general board has said complied with the requirements carried in the army war college military principle. The board may look over any and as many sites as it may see fit and by reason of this fact its work may not be completed for an extended period.

Contracting Delayed

Washington, Dec. 26.—Awarding of contracts for the four battle cruisers provided in the 1917 building program has been delayed by Secretary Daniels. He has taken up through correspondence and personal conference the question of having the four companies revise their bids so that they will be more satisfactory to him. It is his desire that the builders eliminate from their bids the matter of overhead charges, and instead increase the percentage they desire over the cost of construction of the vessels. The bids all were based upon the cost of construction, plus certain percentages of profit, the cost to include not only the matter of labor and material, but other items, such as overhead charges. Mr. Daniels says that so many items could be included in the overhead charges that it might be difficult, if not impossible, for the government and the builders to agree as to whether they are justified. He has suggested therefore that the builders ask a certain percentage to cover the overhead charges, in addition to a certain percentage of profit. It is probable he will seek to have all of them propose the same percentages both as to overhead charges and profits.

The profit asked by the William Cramp & Sons Ship & Engine Co., and the Newport News Ship Building & Dry Dock Co. was 10 per cent, while 15 per cent profit was asked by the Fore River Ship Building Corporation and the Union Iron Works Co. It is understood that Mr. Daniels is endeavoring to have all of them agree to accept a profit of 10 per cent.

Mr. Daniels said that he is considering seriously the matter of enlarging the ship ways at the Philadelphia navy yard in order that one of the battle cruisers may be built at that plant.

Kitchin's Ideas

Washington, Dec. 26.—With the treasury facing a deficit of $300,000,000 for the fiscal year 1918, the administration and congress are trying to devise a way of raising required revenue. No comprehensive program has been determined upon by either, and may not be arrived at until the next session of congress. That there may be a sharp split between the administration and congress as to the method of obtaining the needed revenue is entirely probable.

In the event that there is an effort made by the administration to carry out its alleged tentative plan to tax pig iron, fabricated steel, gasoline, coffee and tea, Majority Leader Claude Kitchin, as chairman of the committee on ways and means will do his utmost to frustrate the attempt. While Mr. Kitchin is of the opinion that there ought to be no further taxes at all, he is ready, if more revenue is insisted upon—as it undoubtedly will be—to urge that most of the taxes come from the profits of munition makers, from increased super-taxes on income and from increased levies in inheritances.

Will Triple Capacity

The H. E. Harris Engineering Co., Bridgeport, Conn., is planning to triple its present capacity and has taken a five-year lease on the property at Broad and John streets, of which it now occupies the second floor. New machinery, principally that used in making tools, will be purchased and the present working force will be doubled. The Harris company manufactures a variety of machine tools, and also designs and installs tools, manufactures special machinery and acts as consulting engineer in manufacturing matters. Harry E. Harris is president and treasurer and Franklin G. Hubbard is vice president and factory manager of the company.

Ford Plant Closed

And Congestion in Detroit is Only Slightly Relieved

Detroit, Dec. 26.—Although the various agencies working in Detroit and vicinity to relieve in some manner the car shortage and the congestion that is threatening big business with embargoes and by failure to move commodities in anything like the required time, accomplished nothing to date, Henry Ford has come forward with the announcement that he believes he can aid the situation and has closed down his mammoth plant.

The Ford factory shut down Dec. 22, will remain closed until Jan. 3, during which time no freight cars will be used by the Ford company for any purpose. In making the rather startling announcement, F. L. Klingensmith, vice president of the Ford company, said that Mr. Ford did not believe that he had any right to use the railways for his business when Detroit and vicinity was threatened with coal and food famine because of the car shortage.

Closing the big plant means that 42,000 employes will lose a total of $1,400,000 in wages during the seven working days of suspension. As the plant turns out 2,500 cars daily, a total reduction of 17,500 cars will be made in production. An attempt will be made to make up this deficiency, but the officers are not sure that this can be done. The only men now in the Ford plant is a small force necessary to unload cars as rapidly as they are brought to the Ford yards and a handful of watchmen. Normally the Ford plant uses 13 carloads of coal a day. While suspended only enough coal to keep the plant above freezing point will be burned.

Ford officials say that the suspension will also give the steel companies sufficient time to catch up with orders.

While the action of Henry Ford is expected to relieve the situation, the congestion in Detroit remains about the same as it has for months. There are still about 12,000 unloaded cars choking the yards and as fast as these are unloaded, others take their places. Embargo committees, railroad officials and others who have studied the situation have reported to their headquarters and that is about as far as the situation has gotten, although threats of the railways of a general embargo are no longer heard and it is believed that the railways would not dare to so isolate Detroit.

The reason for the congestion here is that Detroit is accomplishing industrially in one year what she formerly did in two or more years, and other points are shipping 50 per cent more freight to Detroit than ever before.

Victory for Ford

Who May File Bond and Erect His Blast Furnaces at Detroit

Detroit, Dec. 26.—The ruling of the Michigan supreme court that by filing a bond protecting Dodge Brothers from possible loss, Henry Ford might proceed with his smelting plants on the River Rouge, is not only a victory for Henry Ford, but for Detroit industries as well. With Ford's blast furnaces on the Rouge and that stream deepened by federal action, Detroit sees a great iron and steel center rising on the banks of that important highway of commerce.

In making its decision, the supreme court denied the petition of Dodge Brothers for an extension of the injunction against the expenditure of the accumulated cash dividends of the Ford Motor Co. and also granted Mr. Ford's petition asking that he be permitted to proceed with the smelters.

The court's action is a double victory for Ford. The higher court notifies Judges Wiest, Howard and Chester, of the lower court, to modify the injunction and to allow Mr. Ford to proceed with his contracts so long as he files a bond acceptable to the three judges named. In case the judges refuse the bond, they must show cause why the entire injunction should not be dissolved; this latter seems unlikely.

The court's order follows: "That upon the making and filing in the court below, by the petitioners other than the Ford Motor Co. (Henry Ford), in such form and amount as the said court shall fix and approve, on an undertaking indemnifying the complaining shareholders (Dodge Brothers) against any loss or damages on account thereof, the injunction be modified so as to permit the using or appropriating of the accumulated cash profits on hand, of the defendant Ford Motor Co. for the carrying out and executing of existing contracts for the establishment of a smelting plant and the acquiring of the lands, buildings, machinery or equipment thereof or any other incident thereof, during the pendency of this suit and until the further order of this court; or that the respondents (Judges Wiest, Howard and Hart and Chester) show cause pursuant to the prayer of the petitioners (Ford and his company)."

Coke By-Products

Have Strong Position — Armistice Clause in Contracts

New York, Dec. 26.—Barring the declaration of an armistice on the adoption of peace in Europe, the market on coal tar products manufactured by the iron and steel industry at present holds a strong position for the greater part of 1916 because the expected output for next year largely is sold. A cessation of hostilities would undoubtedly affect radically the situation as so much of this production is going to military purposes. As previously stated, these contracts carry an armistice clause which will operate to suspend shipments within a definite period after fighting ceases. It will require definite action either in the way of an armistice or of peace, however, to bring about these changes and for that reason the market of the past week has not been largely influenced by the peace reports.

In pure benzol, further large contracts for the calendar year of 1917 has been placed by manufacturers of phenol, both domestic and foreign. Most of these have been renewals of 1916 contracts. It is estimated that approximately three-fourths of the 1917 production of pure benzol has been sold. Prices are steady around 55 cents per gallon for both spot and contract. Toluol has become very scarce because of the heavy recent buying largely by Canadian manufacturers of trinitrotoluol. Toluol for war purposes continues to command considerably more than that used for peace needs. Contract prices are from $1.60 to $1.75 per gallon, and spot from $1.75 to $2, depending on the quantity. Phenol, in which there has been large contracting for export manufacturers of picric acid, is steady at 55 to 60 cents per pound. Spot phenol is quoted at about the same prices as contract, but some small sales at 50 cents are noted. The supply of solvent naphtha continues in excess of the demand and prices are heavy around 25 cents per gallon.

Unchanged prices continue in sulphate of ammonia, where the nearby demand still is in excess of supply and prices are rising gradually. This week they are quoted from $4.05 to $4.07½, tidewater, per 100 pounds.

The Eclipse Stove Co., Mansfield, O., will give an entertainment for its sales force and other employes at the Grand Theater, that city, Jan. 4. The moving pictures of Rogers, Brown & Co., "From Mine to Molder", will be displayed, with Sterling W. Hubbard, Cleveland office, as lecturer.

Many Miles of Trackage

Will be Torn Up in Canada in Order to Get Rails for Shipment to France to Help in Military Operations

Toronto, Dec. 26.—Transportation facilities in France having been inadequate for forwarding material and supplies from England to the army, the assistance of the British government has been asked. The co-operation of the Canadian government has been called for to the extent of from 1,200 to 1,500 miles of railway trackage. Owing to the steel works being busy in producing munitions, there is no possibility of securing an early supply of rails, tie plates, bolts, etc., from that source, leaving as the only alternative the taking up of Canadian railway tracks. The railway department has instructed General Manager Gutelius of the government railway system to arrange immediately for the taking up of 300 miles of government railway sidings and the forwarding of such track material as may be immediately available. Some 40 miles of track have been taken up from sidings in eastern Canada and the material laid down at Halifax for shipment and the department is preparing to ship 100 miles of steel every week, provided the British government can supply transportation facilities. The Canadian Northern has undertaken to furnish 200 miles of steel, to be taken from western localities where parallel lines exist or are under construction. It is proposed to give the minister of railways power to order the taking up of existing rails and material wherever it is considered practicable by the Canadian railway board and the railway investigation commission.

J. J. Harty, vice president of the Canadian Locomotive Co., of Kingston, Ont., who is now in England, has secured an order for 40 consolidated locomotives from the British war office.

Second Wage Dividend

The Novo Engine Co., Lansing, Mich., has declared its second annual wage dividend. All employes who have been continuously in the service of this company for a period of 12 months prior to Dec. 1, 1916, will receive an amount equal to 5 per cent of their total wages earned during the year and to those who have been in the employ of the company continuously for a period of six months, but less than 12 months, an amount equal to 2½ per cent of their wages will be paid. This dividend is payable March 1 to those who are then in the service of the company.

Many Stacks Banked

New York, Dec. 27. (By wire.)—The operation of iron and steel companies continues to be seriously interfered with by coal, coke and gas shortages. The Corporation now has 19 blast furnaces banked and about an equal number of independent furnaces are similarly affected.

Personals

George W. Knopf, for the past nine years assistant manager of the Pottstown, Pa., plant of the McClintic-Marshall Co., has tendered his resignation.

R. A. Bull, who recently resigned as production manager of the Commonwealth Steel Co., Granite City, Ill., has been elected vice president and general manager of the Chicago Steel Foundry Co., Chicago. Mr. Bull will assume his new duties on Feb. 1. As a steel casting manufacturer, Mr. Bull takes rank among the leaders in the industry. For two years he was president of the American Foundrymen's Association, and during his leadership this organization had a tremendous growth both in membership and prestige.

Wm. H. Marshall has resigned as president and director of the American Locomotive Co., effective Dec. 31. J. McNaughton, vice president of the company, also has tendered his resignation, effective Feb. 1. Chas. Hayden, of Hayden, Stone & Co., New York, has been elected a director, succeeding Mr. Marshall. These changes have been announced officially by S. L. Schoonmaker, chairman of the board. Mr. Marshall also issued a statement that he intends to take up new duties at a later date, the character of which will be announced subsequently. Mr. McNaughton has been in charge of the operating end of the company for a number of years.

E. S. Christiansen has been appointed manager of the Detroit office of the United Smelting & Aluminum Co., New Haven, Conn., effective Jan. 1. Mr. Christiansen was formerly purchasing agent of the company and was for many years connected with the Haydenville Co., Haydenville, Mass. W. T. Schmitt, formerly with the Bosch Magneto Co., Springfield, Mass., will be assistant manager of the Detroit office.

The Non-Ferrous Metals

Copper Lead Spelter Tin

New York, Dec. 26.—The added impetus imparted to the peace movement by President Wilson's recent note to the various European belligerents, together with the coming of Christmas, combined, during the week closing today, to render the metals market weak and dull. Lower prices have developed particularly in the metals which have been subject to speculation of late. Among these is copper, which now can be had from second hands at much lower prices than those recently prevailing. There is some inquiry for copper but this does not nearly equal the amount offering. Electrolytic is quoted as follows: December, 31.00c to 31.50c; January, 30.50c to 31c; February, 30c to 30.50c; March and April, 29.50c to 30c delivered, cash in 30 days. Lake copper of medium quality is quoted as follows: December, 30.50c to 31c; January, 30c to 30.50c; February, 29.50c to 30c; March, 29c to 29.50c, delivered, cash in 30 days. Ordinary casting copper is quoted at about 28.50c to 29c, cash, for December and January shipment.

Prices on lead have not declined so sharply. The offerings pressed on the market have involved shipment in January principally, whereas the limited demand now current involves mostly prompt. Hence, prompt is held in the outside market at about 7.37½c to 7.50c, New York, and 7.25c to 7.37½c, St. Louis, while January is quoted at 7.25c to 7.37½c, New York, and 7.12½c to 7.25c, St. Louis. At the same time, no large quantities of January are to be had at the prevailing prices. The American Smelting & Refining Co. continues to quote 7.50c, New York.

Demand for spelter is almost totally lacking, and stocks in second hands continue to be pressed upon the market, so that the effect on prices is sharply downward. The market on prime western now is quoted at about 9.25c, St. Louis, for December shipment, and 9c for first quarter.

Prices on aluminum for prompt shipment, despite the fact that there is some demand, and the metal does not show any tendency to accumulate, have reacted, No. 1 ingots in carload lots are quoted at 62c to 64c. No. 1 remelted is quoted at 56c to 58c and No. 12 remelted at 40c to 42c.

The antimony market has undergone practically no change. While the demand is not active, the curtailment in production of late has prevented the accumulation of any large stocks to depress the market; some sellers, however, have been offering futures at somewhat less than the 13.50c, in bond, price recently prevailing. Spot antimony may be quoted at 14.25c to 14.50c duty paid.

(*For complete prices see page* 1326)

HOW A REROLLING MILL TRANSFORMS STEEL RAILS

by R. V. Sawhill

Fig. 1—New Rolling Mill of the Interstate Iron & Steel Co., Marion, O.

A PLANT embodying the latest ideas in rerolling mill practice and construction has been placed in operation recently at Marion, O., by the Interstate Iron & Steel Co. Certain refinement in methods of manufacture and construction have been developed in recent years to a point where they have become practically standard. Among these improvements may be mentioned the widespread adoption of the principle of advancing the materials progressively through the various stages of manufacture; and the substitution of light walls with many windows for the old heavy walls with few windows. In addition to these semi-standardized refinements, the new Interstate mill is notable for its general use of advanced ideas in mill practice.

Plans for the plant were drawn up less than a year ago. Opportunity was thus afforded to incorporate the latest improvements in design and operation. As illustrative, the waste gas from the heating furnace is led to a waste heat boiler which develops 417 horsepower. In place of earlier methods where, under this arrangement, the shut down of the boiler meant stopping the furnace, a simple damper is installed which will divert the gas to a by-pass stack in case the furnace is out of service.

Another example of improved practice is found in the method of handling the water. A hot-water heater receives the waste water that has been heated by passing through the furnace where it cools the pipes on which the rails are supported while being heated. Exhaust steam also is led into this heater. The boilers are supplied from this source, the water thus entering the boilers at a comparatively high temperature.

The new Marion plant is the smaller of two works now operated by the Interstate Iron & Steel Co. The main plant is at East Chicago, Ind.

The Interstate company formerly operated a mill at Cambridge, O. This plant was badly damaged by fire July 18, 1915. While a decision was immediately reached to rebuild the plant, it was also determined to locate

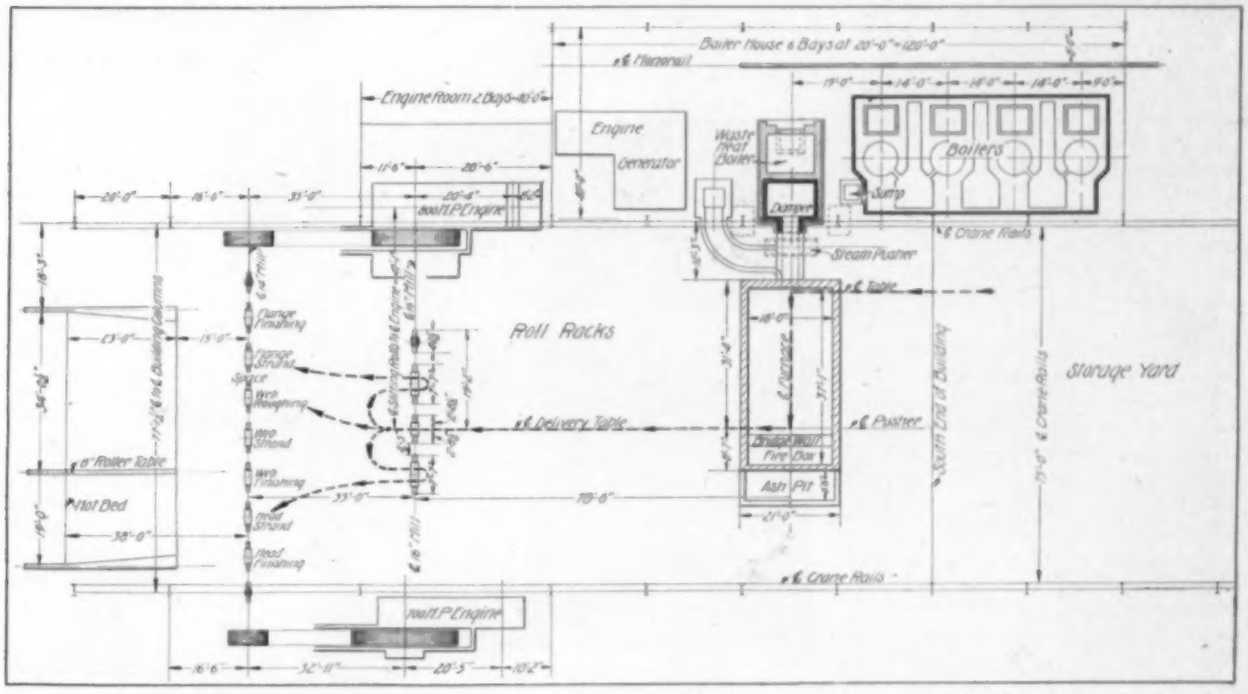


FIG. 2—LAYOUT OF MARION MILL SHOWING ROUTE OF RAILS THROUGH FURNACE AND MILLS

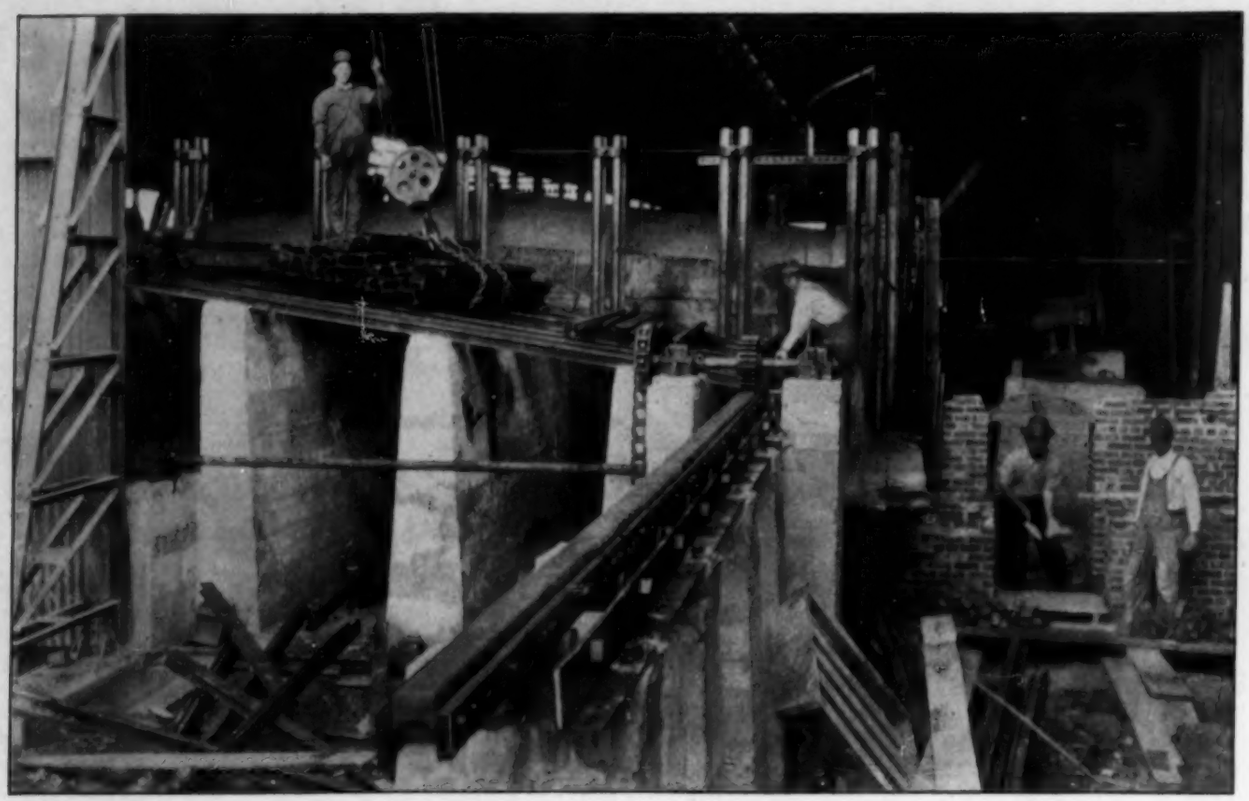


FIG. 3—FIVE-TON BUNDLE OF RAILS ON RAIL SKID READY FOR CHARGING

in some other city. Marion was finally chosen, owing to its central location with respect to the trade served. The railroad facilities offered by Marion are excellent. The new Interstate mill has direct sidings from the Pennsylvania and Hocking Valley railroads, while the tracks of the Erie and Big Four railroads are only a short distance away.

The construction of the mill was completed in record time, after the Marion site had been secured. The initial work of excavation was begun Oct. 26, 1915, and the first rods were rolled May 26, 1916, exactly seven months intervening.

The buildings, power equipment and most of the mills and machine tools are new. Some of the rolling mill and machine tool equipment was brought from Cambridge. Walter Rachals & Co., Youngstown, O., were the engineers who planned the plant.

The multiplicity of products turned out by the Interstate company is surprising to those not familiar with rerolling mill practice. The Marion mill is rolling steel bars in a wide variety of sizes; angles, tees, channels, I-beams, agricultural and other shapes; plain and twisted reinforcing bars; rounds, flats and squares in a varied range of sizes. The capacity of the Marion plant is about 4,000 tons of finished products monthly, the combined capacity of the Interstate company's two plants reaching about 15,000 tons a month.

The main building is representative of the most modern type of mill construction. The structure rests on concrete foundations, some of the concrete piers being sunk 16 feet. The curtain wall is 12 inches wide at the top increasing at some points to a maximum width of 4 feet at the bottom. Unusually strong foundations are used also to support the engine rooms, boiler house and machine shop and the stock yard crane. Extra heavy reinforcements are provided under the mills and engines.

FIG. 4—PEEL READY TO PUSH HEATED RAILS FROM FURNACE

The axis of the mill is in a general north and south direction, with the heating furnace and rolling mills at the south, the shearing and straightening equipment and warehouse at the north and the cooling beds in the center. An 80 x 20-foot bay adjoins on the west side and another bay, 40 x 20 feet 5¼ inches, on the east side. These bays are near the rolling equipment and house the mill engines. Adjacent to the smaller engine room is a 120-foot boiler house. On the opposite side, and also at the extreme south end, is a machine shop, 140 x 36 feet 5¼ inches.

The main mill building is 600 feet long, 77 feet 1½ inches wide and 60 feet high to the top of the monitor. The building is of steel construction with corrugated iron siding and is surmounted by a monitor type roof. The height of the building to the eave line is 28 feet.

The mill is constructed so as to give unusually good light and ventilation. Roller doors occupy the lower one-third of the sides, while the upper one-third is given over to windows. By this arrangement practically 66 per cent of the sides can be thrown open.

The entire mill is commanded by two

FIG. 5—VIEW SHOWING FURNACE, 16 AND 14-INCH MILLS, WITH COOLING BEDS IN BACKGROUND

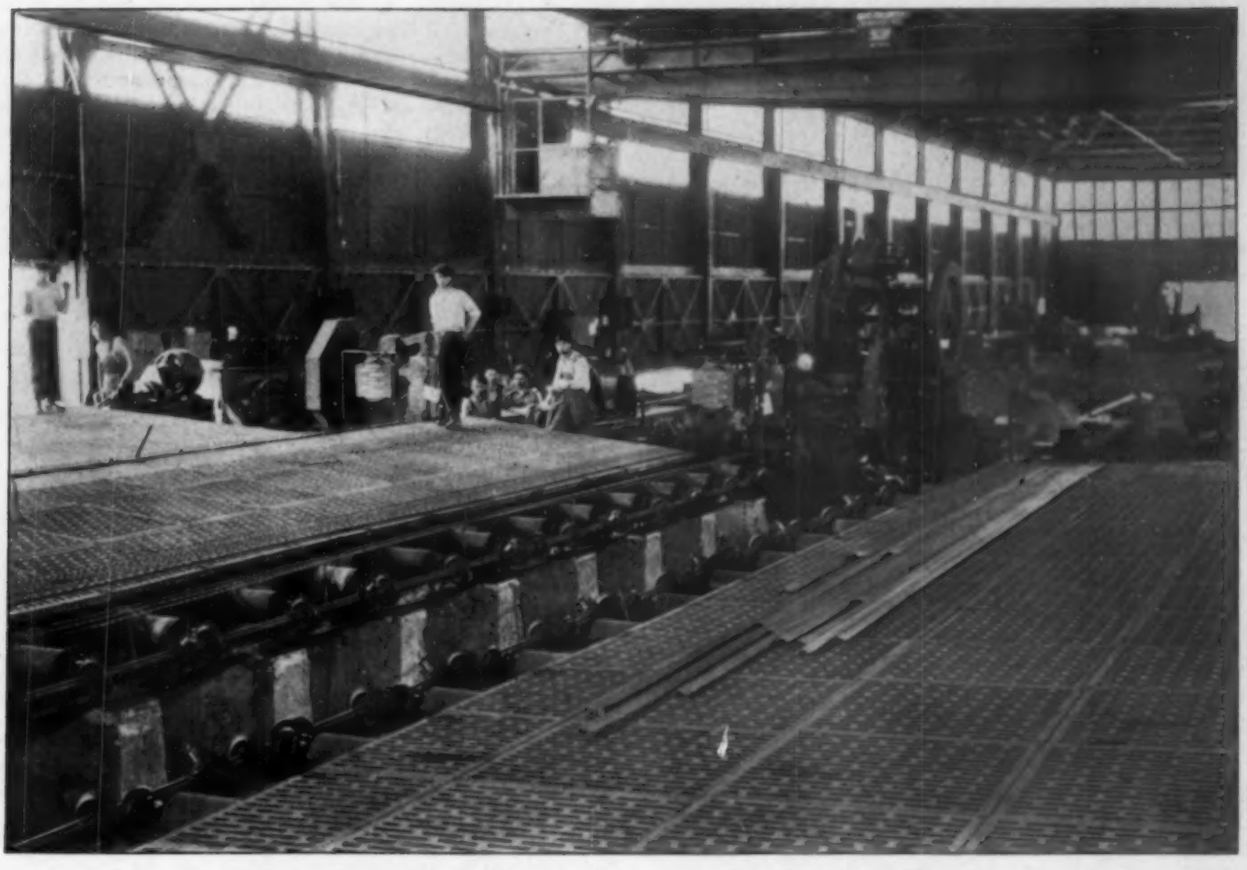


FIG. 6—ARRANGEMENT OF COOLING BEDS AND SHEARING EQUIPMENT

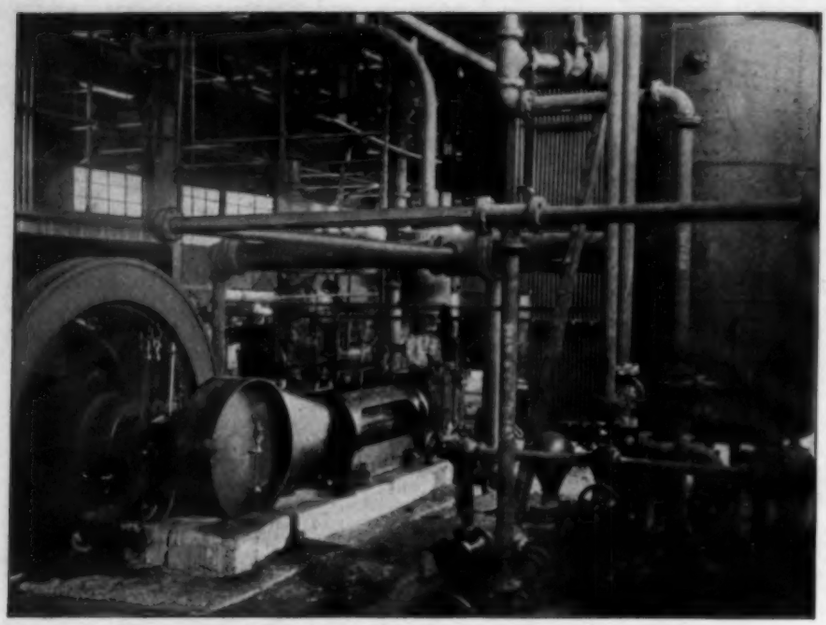


FIG. 7—GENERATOR SET WITH HOT-WATER HEATER AT RIGHT

10-ton Pawling & Harnischfeger cranes, the crane rails extending into the stock yard. This permits the stock yard and mill cranes to be used in either department as required. The mill crane handles finished products or rolls when the latter are being changed.

The raw material for the Marion mill consists exclusively of old steel rails. This restriction insures almost absolute uniformity in the quality of the steel entering into the finished product, as the rail steel has already undergone a severe inspection when first rolled into the form of rails.

All of the incoming rails are unloaded by electric hoists, the railroad sidings paralleling the stock yard. Each rail is handled singly, since they are broken one at a time in the electrically driven breaking machine. Each rail is broken into two pieces, the heating furnace being sufficiently large to accommodate one-half of the ordinary rail.

The broken rails after being broken in the breaking machine are handled by crane and stocked where desired. The entire stock yard is commanded by one of the 10-ton cranes. The rails are stocked according to size, making it a simple matter to locate the sizes required to fill any particular order. A stock from 10,000 to 20,000 tons is carried.

The crane runway is directly south of the main building. It is 500 feet long, with an extreme width of 77 feet 1½ inches, the crane span being 75 feet. The height of the crane runway is 18 feet. There is no break in the crane rails between the mill building and the stock yard, so that the stocking crane also handles rails from the yard to the heating furnace. The foundations for the crane runway are concrete. A monorail system for handling coal is now being installed immediately adjacent to the crane runway.

In operation, the rails are carried in 5-ton lots by crane to the scales directly adjoining the charging table. All rails are weighed before being charged. The rails are then placed on a rail skid by the crane. This skid consists simply of short lengths on concrete piers, the tops of which slope toward the charging table. From the skid the rails are pulled singly onto the table.

The charging and discharging mechanism was designed by the company's own engineers. The two operations are carried on simultaneously, a heated rail being pushed from the furnace at the same time that a new rail is placed in proper position to enter the cold end of the furnace. This rail is then pushed into the furnace by a steamer pusher.

The charging table is at the east end of the furnace, with the rail skid directly adjoining to the west. Beyond the concrete piers is a motor which drives the charging and discharging mechanism, and beyond this motor at the west end of the furnace is the discharging equipment.

The charging table and discharger are staggered, so that when the cold rail is placed directly in front of the furnace, the discharger has pushed the hot rail free of the furnace. Both the charger and discharger are driven by gears which are actuated by motor-driven shafts. These gears direct drive peels, one of which is shown entering the furnace in Fig. 4. One peel pushes the cold rails into charging position, while the other enters the furnace, pushing the heated rail out onto the mill delivery table.

Only two operators are required to control the charging and discharging of the furnace. One workman is stationed at the motor and controls the charger and discharger. The other handles the rails from the skids to the charging table and from the same platform pulls a lever which causes the steam pusher to function.

FIG. 8—FOUR COAL-FIRED BOILERS IN FOREGROUND AND WASTE-HEAT BOILER IN BACKGROUND

This pusher, as shown in the right background in Fig. 3, is placed directly in front of the furnace and actuates an arm which has four rams. These rams push the rail onto the charging plate at the end of the furnace. The furnace is kept filled at all times, so that each cold rail when pushed into position, shoves a hot rail in front of the discharger. Approximately 90 rails are being heated at all times, the temperature being maintained at 2,200 degrees Fahr. The rails are discharged at the rate of three to four a minute, so that each rail is in the furnace for about 30 minutes.

The rails in passing through the furnace are supported on 2-inch extra heavy pipes. Cold water circulates continuously through these pipes. The water enters at the discharge end through a manifold, passes through the pipes in the furnace into another manifold and is then led into a hot water heater for use in the boilers.

Only one heating furnace is required. This furnace, as shown in Fig. 2 directly adjoins the south end of the main mill building. This arrangement is in line with the complete design of the plant, all material working progressively from south to north. From the stock yard at the extreme south end of the property, the rails are handled by crane to the scales and thence through the furnace and mills to the cooling beds, shears and shipping platforms.

The furnace is coal fired. It is 21 feet wide overall, and 47 feet 5 inches from the outer wall at the charging end to the extreme end of the ash pit.

The hot rail on leaving the furnace passes over the delivery table into the 16-inch mill, as shown in Fig. 5. This mill comprises slitting rolls in the center, with roughing stands on both sides. The rail is slit in one pass, being divided into three pieces, the head, web and flange. The head is used for rolling bars and the web and flange converted principally into angles and flats. All products are rolled off the one heat. Fig. 2 shows clearly the arrangement and major dimensions of the 16-inch mill, and its position relative to the furnace, engines and finishing mills.

The head, after being sheared from the rail, is returned through the roughing rolls of the 16-inch mill and after two passes goes direct to the head-strand rolls in the 14-inch or finishing mills. The web passes direct to the roughing rolls in the finishing train, while the flange is returned through the roughing rolls adjoining the slitter and thence to the flange strand rolls. The arrangement of the slitting and roughing rolls is shown clearly in Fig. 2. There are seven mills in the finishing train, three for the web and two each for the head and flange. All of the mills except the slitting rolls are three-high.

Separate cooling beds are provided, one each for the products rolled from the head, web and flange of the original rail. The layout of the three beds is shown in Fig. 5. Each bed is self contained and has individual motors for actuating the rollers which carry the finished products from the rolls to the bed and the cooled products to the shears. Each bed is supported on concrete foundations and is 150 feet long.

FIG. 9—DRESSING ROLLS IN MACHINE SHOP

Two shears are installed at the north end of the cooling beds, a single shear for handling the products made from the rail head and a double shear for those formed from the web and flange. The web and flange products enter their cooling beds from opposite sides so that when cooled and placed on the rollers at the discharge side, they approach the same shear. This arrangement is illustrated in Fig. 6. The two shears were furnished by the Long & Allstatter Co., Hamilton, O.

The equipment in the finishing department includes three twisting machines, one adjoining each bed, which were designed by the company and are used in forming reinforcing bars; three large and one small Kane & Roach straightening machines made by the Kane & Roach Co., Syracuse, N. Y.; one double and two single stock shears furnished by Long & Allstatter; two bending machines for bending reinforcing bars, and scales. Six more stock shears are now being installed. All products after being cut to size are placed in trays, thus permitting them to be handled easily by the crane either into railroad cars for immediate shipment or into stock. A railroad siding parallels the finishing and warehouse departments on the east, inside of the mill, enabling shipments to be handled directly into the cars by crane.

The slitting and roughing rolls and three of the finishing rolls are driven by an 800-horsepower, heavy-duty Allis-Chalmers engine with a 30 x 48-inch cylinder. The balance of the finishing rolls are driven by a 700-horsepower heavy duty Hooven, Owens, Rentschler engine with a 28 x 54-inch cylinder. Rope drive is used with both engines.

Fig. 2 shows clearly how either engine in an emergency can be employed to drive additional mills. In case the 700-horsepower engine is out of commission, idlers can be inserted in the "space" shown between the flange strand and web roughing rolls, thus connecting both mills to the 800-horsepower engine. If the larger engine is disabled, the slitting rolls can be placed in the finishing train in place of one of the other mills and all mills except the two roughing rolls driven by the 700-horsepower engine.

Auxiliary power is supplied by a 220-kilowatt generating set consisting of a 275-horsepower, heavy-duty Allis-Chal-

mers engine, with a 20 x 30-inch cylinder, direct connected to a 220-volt generator furnished by the Bullock Electric Mfg. Co., Cincinnati.

Five boilers, four of the vertical and one of the horizontal water-tube type, with a capacity for developing a total of 1,417 horsepower, are employed. Four boilers are coal-fired, the fifth operating on waste gas from the heating furnace. The waste heat boiler develops 417 horsepower and was furnished by the Oil City Boiler Works, Erie, Pa. It is shown in the background in Fig. 8. The four coal-fired boilers develop 250 horsepower each. They were furnished by the Bass Foundry & Machine Co., Ft. Wayne, Ind. These boilers have 80-foot stacks, 42½ inches in diameter at the base. The waste heat boiler has a 30-foot stack, with a diameter at the base of 34 inches.

The waste gas from the heating furnace is inducted to the boiler by a fan installed by the Bayley Mfg. Co., Milwaukee. The fan is driven by a 20-horsepower General Electric motor. A by-pass stack, 125 feet high and 5 feet 3 inches in diameter at the base, is provided for discharging the waste gas in case the boiler is not in service. The gas is easily diverted from the boiler to the by-pass stack, a damper controling the flow of the gas. By this arrangement, it is possible to operate the furnace, whether or not the boiler is in commission.

A monorail crane is now used for unloading the coal, the boilers being hand fired. Plans under consideration provide for the installation of automatic stokers.

Water for the boilers is preheated by passing through the pipes which support the rails in the furnace. The water is stored in a tank which has a capacity of 25,000 gallons. All water used in the boilers is passed through a softening tank where it is agitated in a solution of hydrated lime and soda ash. The softening tank has a capacity for treating 6,000 gallons of water per hour. The hardness of the water is reduced from 28 to 32 grains to four grains.

The water after being softened flows by gravity through the furnace and thence into a hot water heater shown at the right in Fig. 7. From the heater the water is pumped into the boilers. The pump was furnished by the Columbus Steam Pump Works Co., Columbus, O. Exhaust steam from both engines also is led into this heater.

Electricity Widely Used

Practically all of the equipment with the exception of the mills is electrically driven. In addition to the generator set, 40 motors are used about the plant. These motors are largely of the General Electric and Westinghouse types and range from 2½ to as high as 50 horsepower. In a rerolling mill, the problem of changing the rolls rapidly has greater significance than in almost any other type of rolling mill. The great number of sizes and shapes rolled necessitates frequent changes of the rolls. The officials of the Interstate company gave special study to this problem and will shortly inaugurate a system that is expected to reduce the roll-changing time to a minimum.

It is planned to store several complete rolling mills adjacent to the mill trains, these mills being complete with housings and rolls in place. When a shift is necessary, one complete mill will be lifted free of the train, and the new mill put in place. These extra mills can be made ready in advance of the time when actually required. Roll racks are installed immediately adjoining the delivery table from the furnace to the 16-inch mill. Rolls will be stored three high in these racks, the top rolls of the mills at the bottom, and the bottom mill rolls at the top.

The machine shop is commanded by a 5-ton Pawling & Harnischfeger crane. It is fully equipped for handling repair work, dressing rolls, etc. The equipment includes a steam hammer, an 8-foot Niles-Bement-Pond planer, two Barnes drill presses, one Ohio and one Rockford shaper, two machine lathes, one single and one double roll lathe, pipe and bolt threaders, hack saws and emery stands. All the tools are motor-driven from two motors, one of 10 and one of 15 horsepower. Current can also be received from the public service corporation in an emergency. A gas-fired tempering furnace will be installed shortly.

For lighting the main building, 23 1,000-candlepower electric lamps are employed. Thirteen lamps varying from 500 to 1,000 candlepower light the bays, machine shops and yard. Current is supplied from the company's own generating set.

INDUSTRIAL SAFETY GOGGLES

No Shattered Glass

An industrial safety goggle has just been put on the market by the Chicago Eye Shield Co., 134 South Clinton street, Chicago, which is designed to obviate trouble from splintered lenses. Tests have shown, it is stated, that the glass is of sufficient toughness to resist splintering and when broken the parts all remain in the frame. Nails have been driven through the lenses without shattering the glass. This type of protector has been tested by the safety department of the Illinois Steel Co. and met the requirements of that company's safety specifications.

The lens is mounted in an annular frame with a ridge on its circumference which engages a groove in the goggle frame, holding the lens tightly but allowing for an easy removal when pressure is applied. A broken lens can be taken out and a new one replaced in a few seconds, without tools. The bridge of the goggle frame may be adjusted by bending and due to this construction one size is suitable for practically all shapes of noses or widths of faces. Provision is made for a leather band about the goggle frame for use in situations where excessive heat is encountered, to protect the face from heated metal parts. Any tint or color of lens may be employed which enables the user to work where dangerous light rays are encountered. The glass is of American manufacture and not subject to difficulties of importation.

The Plastic Elongation of Wire

An Attempt to Account for the Phenomena of Creep or Slow Stretch of Wire Under Load, and the Subsequent Self-Hardening, by an Interpretation of the Amorphous Cement Theory

BY A. V. DE FOREST

IN THE course of tension tests on wire, using a dead-load method, it was observed that brass wire stretched very differently from copper, aluminum, nickel, soft iron and German silver. These latter stretched in a fairly uniform manner, that is, the stress-deformation diagram showed an apparently smooth curve, while that for brass was an irregular one. Turning to the literature it was found that this phenomenon is clearly shown in Dalby's autographic stress-deformation diagrams, and is evidently the same effect as the well-known self-hardening of bronze, and certain aluminum alloys when tested in the usual manner. The amorphous cement theory, advanced by Beilby and extended by Rosenhain, seems to offer a simple explanation of this matter, and further experimental work was undertaken to support the theoretical reasoning.

As is universally known, the amorphous theory accounts for the hardening effect of cold work by assuming that a layer of amorphous material, sub-microscopic in thickness, is formed on the cleavage planes, and between grains where slip has occurred. This material is assumed to be of the nature of an under-cooled liquid, such as glass, stiff and brittle. The effect of this intergranular layer is to cement into rigidity the enclosed blocks of crystalline material. After the metal has been deformed, it may thus be regarded as composed of broken parts of the original grains, in the form of crystalline blocks, surrounded and supported by the amorphous cement. The manner in which the metal yields to a deforming force will then depend on the relative resisting power of the two components.

Little Direct Evidence

There is little direct evidence on this point, but what seems a simple idea of the matter will account for the observed facts. At room temperature the cement formed between crystalline blocks of some metals requires a considerable time in which to reach its maximum supporting power. Muir's experiments on mild steel show that several days are required before overstrain tension specimens reach their greatest elastic limit. Howe has likewise shown that iron and mild steel behave in a similar way with respect to hardness. Using a word readily suggested by the term "cement", it would seem that the amorphous layer required a given time in which to set. This time might be expected to be dependent on the temperature, whatever the nature of the setting process; whether or not this process consists in the recrystallization into the adjacent crystalline blocks of the surplus amorphous material, leaving a layer of the same order of magnitude as that filling the original intergranular spaces. In fact, both the above experimenters found the time required for setting was reduced from a few days to a few minutes by heating the metal to 100 degrees Cent. Whether the properties of the crystalline component are changed by such a small change in temperature is unknown, but it seems reasonable to suppose that the effect of such change on the unstable cement would be greater than that on the stable crystalline matter. Even the unstable forms of hardened steel are apparently little changed by heating to 200 degrees Cent. As the facts can be readily explained without assuming such a change, it will be omitted for the sake of simplicity in the present case.

The setting process is then probably largely a function of the temperature. It may likewise be supposed that the viscosity of this substance is also affected by smaller changes in temperature than those which sensibly affect the crystalline particles. The rapid elongation under constant or diminishing loads found by many

A paper presented at the nineteenth annual meeting of the American Society for Testing Materials.

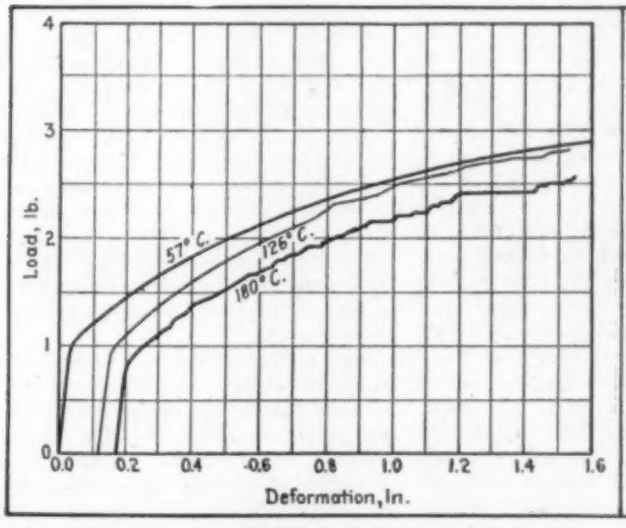


FIG. 1 — STRESS-DEFORMATION DIAGRAMS FOR ANNEALED PHOSPHOR-BRONZE WIRE— TIME OF LOADING, 3½ MINUTES

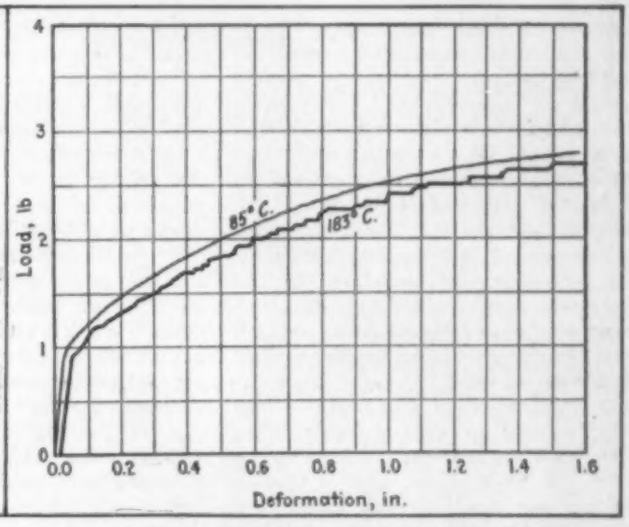


FIG. 2—STRESS-DEFORMATION DIAGRAMS FOR ANNEALED PHOSPHOR-BRONZE WIRE — TIME OF LOADING 16½ MINUTES

workers at higher temperatures, and the great intergranular brittleness found by Rosenhain at temperatures close to the melting point, indicate a great change in viscosity.

From these considerations it would seem that a metal subjected to a gradually increasing dead load would stretch smoothly and uniformly, when the rate of stretch and the temperature were such that the cement would set comparatively slowly. The blocks of crystalline material moving along the slip planes would be supported by an amorphous layer so viscous that no rapid motion would be possible. The motion of the blocks would be gradually checked by the increasing area of cement, and its increasing stiffness as time was allowed for it to set. The retardation would be gradual and the end of the motion would be imperceptible. Under these conditions the stress-deformation diagram would be a smooth curve, such as is usually obtained from copper.

As the temperature is raised, the cement between the blocks of crystalline matter becomes less viscous at its formation, and therefore the slip becomes more rapid. Also the time required for setting is less, and the relative motion of the blocks is more suddenly arrested. As the deformation increases, slip along new planes begins, only to stop suddenly when the resulting cement stiffens in its turn. A much slower rate of loading might also result in the same form of irregular stress-deformation diagram, for the mobile phase formed by any one slipping movement would have time to yield to a perceptible degree before the load became sufficient to develop slip along new planes.

At annealing temperatures the existence of the amorphous material would seem to be limited to that in the intercrystalline spaces, for any formed between planes of crystalline matter of the same orientation would probably be instantly reabsorbed by the growing crystal. There would then be practically no viscous yielding of amorphous material between moving blocks, and it seems probable that the slips would be so minute as to integrate into continuous motion, showing a smooth curve for the stress-deformation diagram, as at low temperatures. At high temperatures, just below the melting point, the amorphous cement is perhaps so fluid as to allow the crystal grains to fall apart under very small stresses. This has been demonstrated by Rosenhain.

In the stress-deformation diagram the setting of the cement should be registered by an increase of strength shown by a break in the curve toward the vertical, provided the viscosity of the amorphous material in its mobile state is not sufficient to mask this effect. When a tension test is carried out slowly enough, the viscous yielding of the material is noticed in an ordinary testing machine as creep, and the setting of the cement as self-hardening. In the curves, creep is shown as a break toward the horizontal, and self-hardening by a change in direction toward the vertical. Some of these effects are clearly shown by the results of tension tests on wires. Fig. 1 represents autographic stress-deformation diagrams from tests on phosphor-bronze wire loaded at a uniform rate. It will be seen that at 57 degrees Cent. the curve is smooth, as it is at room temperature; at 126 degrees Cent. there are wavy irregularities; and at 180 degrees Cent. the irregular curve is broken by horizontal lines representing very rapid slips. The rate of loading is the same in each case.

Fig. 2 shows curves from similar wires at a slower rate of loading. At 85 degrees Cent. the curve has begun to show slight irregularities, and at 183 degrees Cent. it is practically a broken line.

In wires of this composition the viscosity of the cement is so great that there is no increase in strength at the moment of set until the temperature reaches about 60 degrees Cent. At 126 degrees Cent. there is an intermediate condition, and at 180 degrees Cent. the viscosity is so small as to allow the wire to stretch rapidly with but little resistance until the setting of the cement suddenly stiffens the metal, and a considerable increase in load is necessary to again produce an elongation.

Fig. 3, from tests on brass wire, shows the same effect. At room temperature this wire gives a curve showing slight irregularities. A lower temperature would undoubtedly give a smooth curve. At 129 degrees Cent. the curve is a series of straight lines. Here the viscosity of the cement is so small, and recovery so complete that after each stretch the metal has

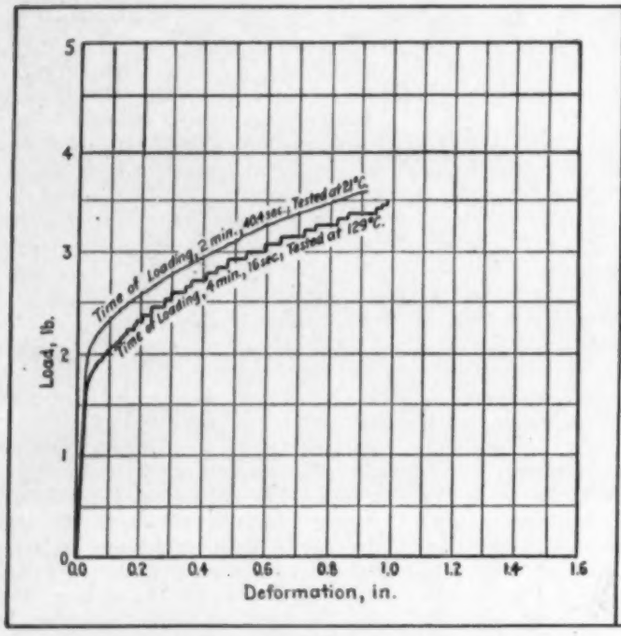


FIG. 3—STRESS-DEFORMATION DIAGRAMS FOR ANNEALED BRASS WIRE B

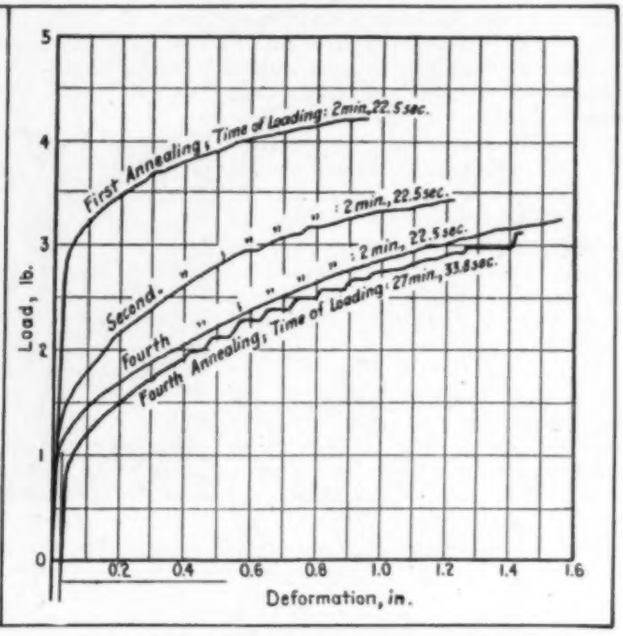

Load, lb.
Deformation, in.
First Annealing; Time of Loading: 2 min., 22.5 sec.
Second " " " " : 2 min., 22.5 sec.
Fourth " " " " : 2 min., 22.5 sec.
Fourth Annealing; Time of Loading: 27 min., 33.8 sec.

FIG. 4—STRESS-STRAIN DIAGRAMS FOR ANNEALED BRASS WIRE A

hardened into a state exactly similar to its condition below the elastic limit. Each vertical portion of the curve is therefore exactly parallel to the portion below the elastic limit.

In Fig. 4 the curves for material tested after fourth annealing show the same effect, but it is produced solely by a change in the rate of loading. With rapid loading the cement has not time in which to yield before new slip planes are developed by the rapidly increasing load. When loaded slowly, in 27 minutes, the cement has opportunity to yield and set firmly before the increasing load again produces a slip.

Owing to the limitations of the apparatus, it was impossible to prove that in the above cases the stress-deformation diagram would again become smooth at higher temperatures, but the work of Rosenhain and Humfrey; of Pisati, as quoted by Huntington; and the experiments on brass, by Bengough and Hudson, indicate that the irregular stretching at intermediate temperatures is followed by regular elongation at higher temperatures. The last two report the production of sound, perhaps while in the region of irregular stretch.

The remaining curves of Fig. 4 show the effect of the temperature of annealing on the brass wire used in the experiments.

The form of apparatus which was adopted after several trials is shown in Fig. 5. A large pulley is supported by a frame work, on one side of which hangs a bucket of water, balanced by a counterweight on the other. Below the bucket is an oil bath with electric heater, at the bottom of which one end of the specimen is fastened. The other is secured to the bottom of the bucket and pulled up, the weight on the wire being exactly the weight of water which was allowed to flow out of the bucket through a nozzle in the bottom. A spot of light reflected from a mirror displaced by the motion of the bucket, and from a second mirror moving proportionately to the weight of water caught in a receptacle placed on a spring balance, drew the stress-deformation diagram on a piece of bromide paper. Annealing was done in a small resistance furnace, and temperatures measured with a thermocouple and galvanometer.

Helping the Worker

The Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., recently published a booklet entitled "The Worker and Works", showing what the Westinghouse company has done in providing modern methods for increasing the safety and comfort of its employes. Guards, enclosures and warning signs are placed throughout the works to lessen the danger of accidents. Gears and belts liable to cause injury to the workmen, as well as elevator shafts, dangerous offsets, circular saws, and other possible danger zones are enclosed with guards, while goggles and shields are provided to protect the eyes from flying chips. An endeavor is made to keep all aisles clear to facilitate rapid exist of employes in case of fire or panic, and fire drills are required at regular intervals throughout the year.

A magazine, the *Westinghouse Electric News*, is issued each month, and distributed to every employe free of charge. The matter published consists of personal, safety and health hints, accounts of social activities, suggestions, etc. The Westinghouse Club, an organization of company employes, provides reading, writing and studying rooms, billiard and lounging rooms and an auditorium for lectures, smokers and dances. A technical night school is also maintained by the company. A relief department supported by dues from employes provides for payment of benefits to its members in case of sickness or death. The company bears the expense of maintaining this department. Accident compensation and service pensions are other features of the general plan of welfare work.

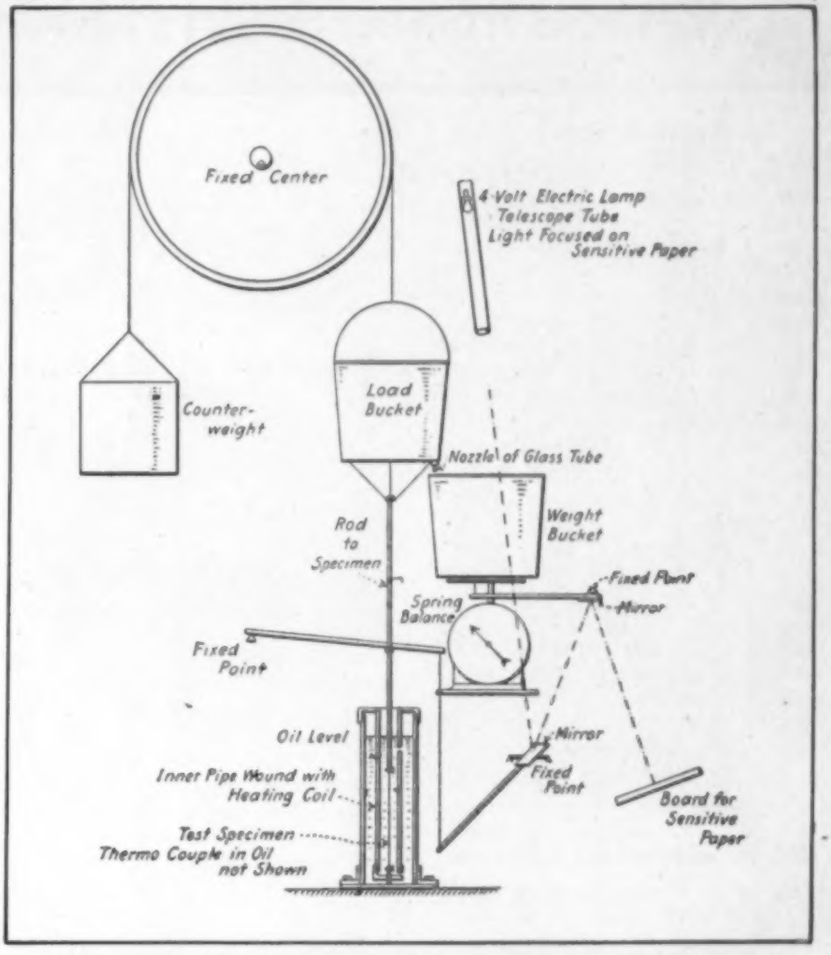


FIG. 5—APPARATUS FOR DRAWING STRESS-DEFORMATION DIAGRAMS

Book Review

Plain and Ornamental Forging, by Ernst Schwarzkopf; cloth, 267 pages, 5¼ x 7½ inches; published by John Wiley & Sons, Inc., and furnished by *The Iron Trade Review* for $1.50 net.

Plain and Ornamental Forging is a practical shop text on the general subject of art metal and blacksmith work. As the book is intended for the beginner the opening chapters are necessarily elementary and simple, but the work grows more advanced in succeeding chapters. The materials and tools used by the smith are described and the various processes of manufacture are explained. Many excellent illustrations accompany the text and augment the value to no little extent.

WHAT'S WHAT and WHY

Don't Ask Yourself-Ask Us!

Questions from our Readers answered by Experts

Indian Steel

What is "Indian Steel", where is it made, and by what process?

Indian or Wootz steel is manufactured from wrought iron made in a native (India) furnace by placing about one pound of metal in a small crucible of refractory clay with a certain proportion of finely chopped wood. The crucibles are then covered with leaves and damp clay and then dried in the sun. When the molds are thus hardened, 20 to 24 of the crucibles are placed in an arched form on the bottom of a small blast furnace and strongly heated for two or three hours. The furnace is then allowed to cool, the crucibles removed and broken—the steel having melted to a rounded cake in the bottom of the crucible. The steel usually is overcarburized, probably in order that it may be completely melted. Before drawing into bars, the cakes are decarburized by heating in charcoal at a temperature near their melting point.

By-Product Coke Plants

What is the coal consumption of the by-product coke plants in the United States? How will this consumption be affected by the completion of plants now in the course of construction? If possible, please state the approximate output of coke from by-product ovens in this country.

According to statistics recently gathered by Horace C. Porter and presented in a paper read before the recent New York meeting of the American Chemical Society, there were 6,756 by-product ovens in the United States Sept. 1, 1916. The annual consumption of coal amounts to 29,827,000 net tons. On Sept. 1 there were 2,236 by-product ovens under construction, and when completed, these will consume 13,867,000 net tons of coal per year. The total coke output of completed plants is 22,479,400 net tons per year, while the plants being built Sept. 1, will have a capacity for 10,126,600 net tons per year. When all of the plants under construction in September have been completed, there will be in the United States a total of 8,992 ovens, using 43,694,000 net tons of coal and producing 32,606,000 net tons of coke.

Percentage of Carbon in Steel

How can the percentage of carbon in steel be determined accurately? Some say that this can be done by looking at it; is this so?

The only precise way of determining the percentage of carbon in steel is by chemical analysis. It may be closely estimated, however, by a microscopic inspection of the surface. To do this the surface must be carefully polished and etched.

The magnified view then is made through a 100-mesh screen. The percentage of squares filled with the darkest material is counted, and one-fifteenth of this carbide approximates the percentage of carbon in the steel. An experienced furnaceman also can judge the amount of carbon in steel with fair accuracy by a simple inspection of the freshly fractured surface.

American Cold Rolling Mill

We understand that machinery for manufacturing cold rolled strip steel is built only in Great Britain and Europe. Is this condition true at the present time?

No. Since the war broke out several prominent American manufacturers of rolling mill machinery have developed mills for cold rolling which are considered the equal of any European product. Cold rolling equipment is manufactured in the United States for rolling steel, copper, brass, aluminum, zinc, etc. Mills with rolls up to 20 inches in diameter have been built.

Non-Magnetic Steel

We would like to know what is meant by the term "non-magnetic steel". If there is such a substance, of what is it composed, and what are the characteristics?

Steel, of course, is inherently a magnetic substance and the only kind of steel which has been found to be non-magnetic is a manganese alloy, containing 12 per cent or more of manganese. Owing to the hardness of this alloy, it ordinarily is cast nearly to shape and finished by grinding, although recent experiments have been made in rolling it. As cast, it is extremely brittle, and to eliminate this undesirable feature, it is heated to a fairly high temperature and quenched in water. This has the effect of rendering the metal more ductile without removing the quality of toughness. Such alloys possess a tensile strength of 150,000 pounds per square inch and in some cases elongation has approached as high as 50 per cent.

Cold Working of Steel

What is cold working of steel and what is its general effect on the material?

Speaking broadly, cold working is any process which strains cold metal slightly beyond its elastic limit. This may consist of rolling, hammering or drawing to reduce slightly the cross-sectional area, or distorting by bending or twisting. The manufacture of cold-drawn shafting is an example of the former and cold-twisting of reinforcing bars is an example of the latter. Tensile strength may be increased 20 to 40 per cent and the elastic limit 60 to 100 per cent by cold working. Cold bending and pressing are resorted to more to gain a desired shape than for any particular effect it may have on the condition of the metal.

Roughing Cut Causes Axle Failure

The Importance of Careful Fabrication of Machine Parts is Emphasized in This Article Which Indicates How the Roughing Cut of a Forging for a Locomotive Axle Was Responsible for Its Failure

THE CAUSE of the failure of the main driving axle under freight engine No. 1056 of the Southern railroad, resulting in a serious accident, was an area of metal at the surface of the journal, which contained chatter marks and short incipient cracks made by the roughing cut in the machining of the forging from which the axle was made. At one place only along the length of the journal were these incipient cracks in evidence, and at that place the line of fracture had its origin. This condition represented a defect in the machine finishing of the axle. The finishing cut in the lathe did not remove the metal which had been injured by the roughing cut.

The mechanical fit of the hub of the left-hand driver was confined to a small part of the length of the wheel seat of the axle. This led to the formation of a number of fractures starting in the axle in the wheel seat, which were necessarily obscured from view by the hub. These fractures were in an advanced stage of development when complete failure at the journal occurred. Incidentally, but not bearing upon the failure of the axle, it may be remarked that two groups of holes, 1 inch in diameter by 1 inch deep each, were drilled and plugged, representing an error in the location of two keyways in the middle portion of the axle. The axle in question was made, quite evidently, from an untreated, solid, steel forging, and was finished turned thoughout its length. Fig. 1 shows the shape and dimensions of the axle, on which are entered notes descriptive of the examination which was made of the metal. The line of rupture started in the periphery, about 5 inches from the inner end of the journal, indicated by a star on the sketch of the axle, thence taking an oblique course, ultimately separating the axle. The fracture was progressive, according to the evidence presented by the ruptured surface. It appeared to have developed gradually until about one-quarter of the cross section was separated, after which the remaining stages of rupture were rapidly completed.

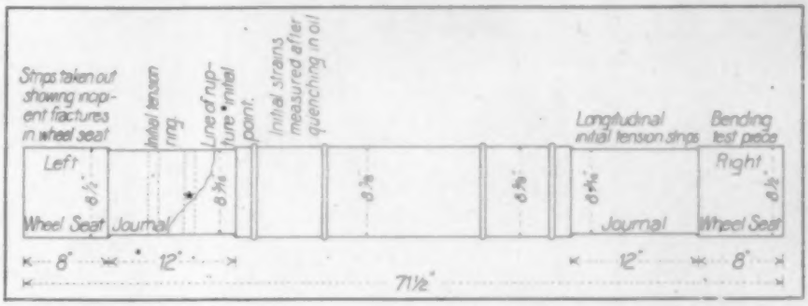


FIG. 1 — SKETCH OF AXLE SHOWING LOCATION OF FRACTURE

FIG. 2 — END VIEW OF FRACTURED SURFACE OF JOURNAL; POINT OF RUPTURE INDICATED BY STAR

Fig. 2 is an end view of the fractured surface, on which is also placed a star to indicate the incipient point of rupture. Two drilled holes in the fractured surface are shown by the figure, where chips of the metal were taken for chemical analysis.

This article is taken from the report of the chief of the division of safety, interstate commerce commission, covering the investigation of an accident which occurred near Hoffman, Ill.

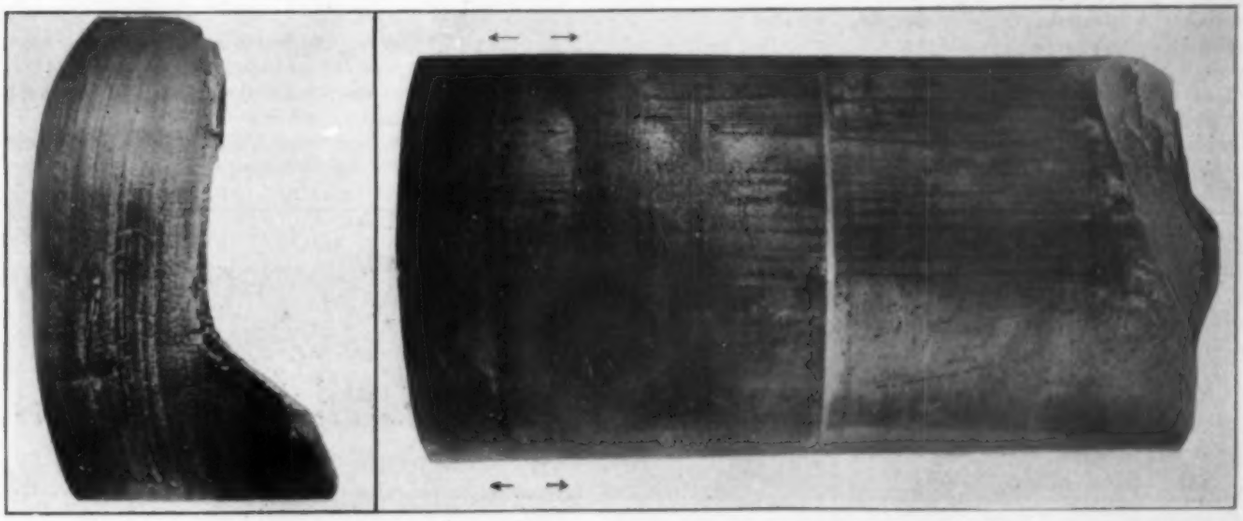


FIG. 3—APPEARANCE OF THE SURFACE OF JOURNAL NEAR INCIPIENT POINT OF RUPTURE. FIG. 4—SIDE VIEW OF BROKEN AXLE SHOWING OBLIQUE SURFACE OF FRACTURE

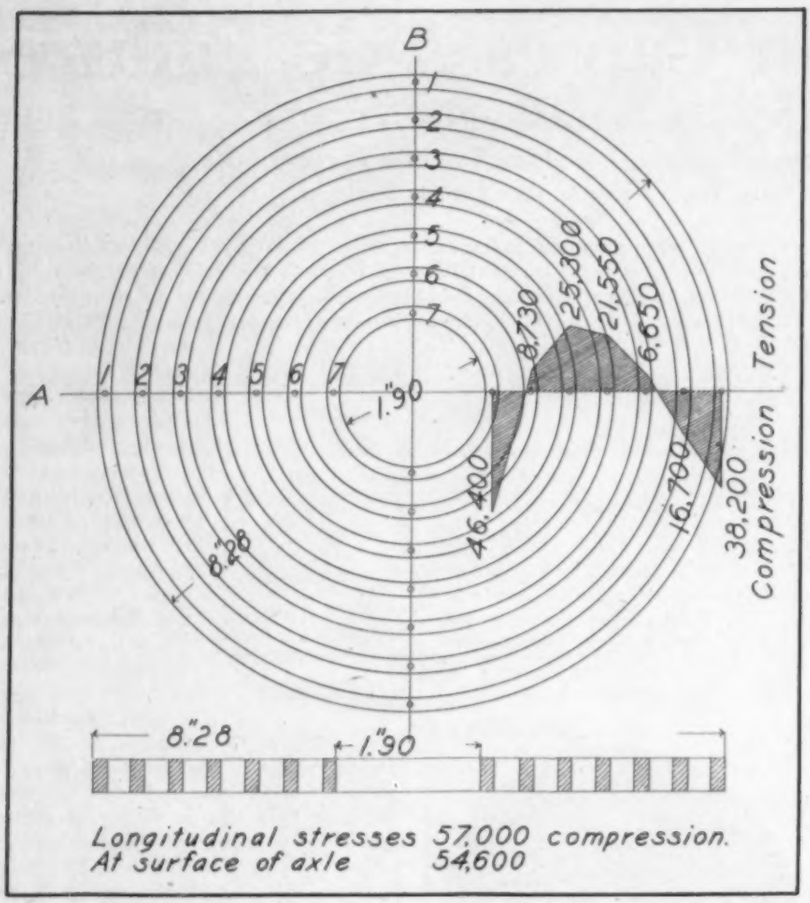


FIG. 5—MANNER OF TAKING TEST RINGS—SHADED PORTIONS ILLUSTRATE GRAPHICALLY THE INITIAL STRAINS FOUND IN THE RINGS

Fig. 3 shows the appearance of the surface of the journal in the vicinity of the incipient point of rupture. The illustration is about twice natural size. The shattered condition of the surface of the metal, attributable to a heavy roughing chip in the lathe, is shown by this illustration. These short cracks penetrated the metal depths of 0.02 to 0.03-inch. They were made more pronounced in appearance, as here illustrated, by bending the metal, which opened the cracks somewhat.

Heavy machine tool-cuts tear the metal and also introduce internal strains. There is a close resemblance in the effect of such heavy tool-cuts to shearing and punching effects, if, indeed, they are not of the same order. Shearing and punching of steel is very properly prohibited in certain specifications. It is important that equivalent effects be avoided which may result from using lathe and planer tools with heavy cuts and feeds.

The limited area of bearing surface of the hub of the left-hand driver on the wheel seat of the axle was a notable feature. It ranged in length from 1¾ inches down to ½ inch only. This zone of contact was near the outer end of the axle, 1¾ inches distant from it. Beyond this zone in either direction there was some looseness of the wheel on the axle. The location and irregular shape of the bearing surface on the wheel seat is shown by Fig. 4.

Circumferential cracks were visible on the surface of the wheel seat at and near the inner border of the bearing surface. These cracks ranged in length from ½ inch to 2½ inches, in all aggregating about one-half the circumference of the axle. Fig. 6 represents a segment of the wheel seat, showing the width of the bearing surface of the hub at this part of the axle, also the location of two fractures, one near the zone of bearing of the hub and the other near the inner end of the wheel seat, in close proximity to the journal. The length of bearing surface here was from ½ inch to 15/16 inch long. One fracture had a depth of ¼ inch; the other fracture, near the journal, had a depth of 1 inch and a circumferential length of 2 inches.

Fig. 7 shows some of the fractures which were in process of development in the left-hand wheel seat, which would undoubtedly have extended and caused complete rupture of the axle had not the fracture of the journal taken place. The axle was in a critical state in this part of its length.

An examination of the right-hand wheel seat showed the hub of the wheel had a bearing over substantially its full length. A bending test of a strip of metal from this wheel seat showed good bending properties and did not display the presence of any incipient cracks in the steel.

An initial tension ring, so-called, was taken from the left-hand journal just outside of the line of rupture. The internal strains in the surface metal of the journal were those of tension. In a tangential direction the tensile stress corresponding to the mean strain of two diameters was 5,300 pounds per square inch. The presence of tensile strains at the surface of the journal is accepted as evidence that the metal had not been cold rolled for finishing purposes, or, if so, with very little effect, since the usual rolling, to smooth the jour-

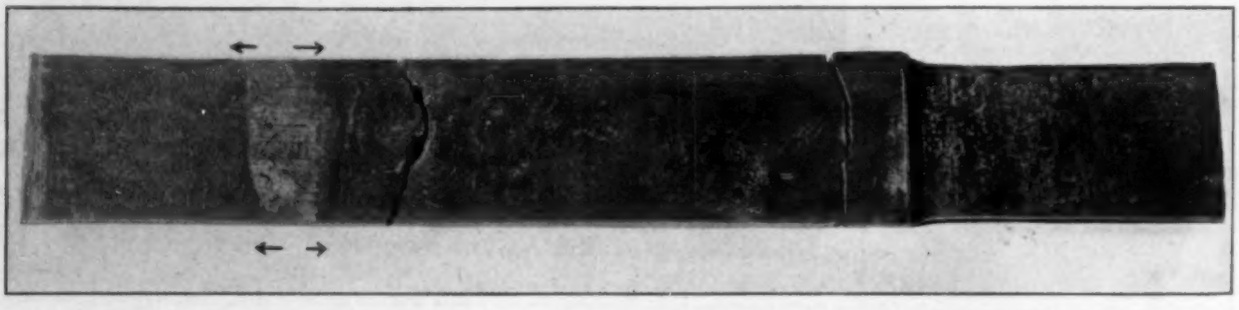


FIG. 6—SEGMENT OF FRACTURED AXLE SHOWING LIMITED LENGTH OF BEARING OF THE HUB OF DRIVER ON THE WHEEL SEAT, SHOWN BY WITNESS MARKS

nal, puts internal strains of compression in the surface metal. A deep cut and heavy feed in machine tooling is competent to introduce strains of tension in the surface metal; therefore, the evidence furnished by this initial tension ring is consistent with the indications furnished by the chatter marks that such a cut had been taken during the fabrication of the axle.

Physical Properties of Axle

Longitudinal strips were taken from the surface metal of the opposite journal. The internal strains at that end were of compression, one strip showing a strain equal to 4,500 pounds per square inch, another from the opposite side of the journal showing 8,400 pounds per square inch.

A tensile test of the metal, with a 2-inch longitudinal specimen, 0.492 inch diameter, from the metal near the surface of the left-hand wheel seat, showed an elastic limit of 45,260 pounds per square inch, tensile strength 79,470 pounds per square inch, with 27 per cent elongation and 40.5 per cent contraction of area. The metal showed a silky fracture.

The chemical analysis of the steel was as follows: Carbon, 0.44; manganese, 0.95; silicon, 0.19; sulphur, 0.015; phosphorus, 0.03.

A section, about 3 feet long, from the middle of the length of the axle was heated to a temperature of 1,550 degrees Fahr., and quenched in oil. A hole 1.9 inches diameter had previously been drilled through the axis of the piece. Tangential and longitudinal strains were measured, representing those introduced by the sudden cooling of the metal.

The Effect of Quenching

It might be expected that some apprehension would arise concerning the possibility of incipient fractures being introduced by the operation of quenching, spontaneous rupture taking place. This apprehension is, in fact, shown in certain specifications which require a shock test to be made of heat-treated axles to detect whether interior fractures have not been made by the process, thereby impairing the strength and the safety of the axle.

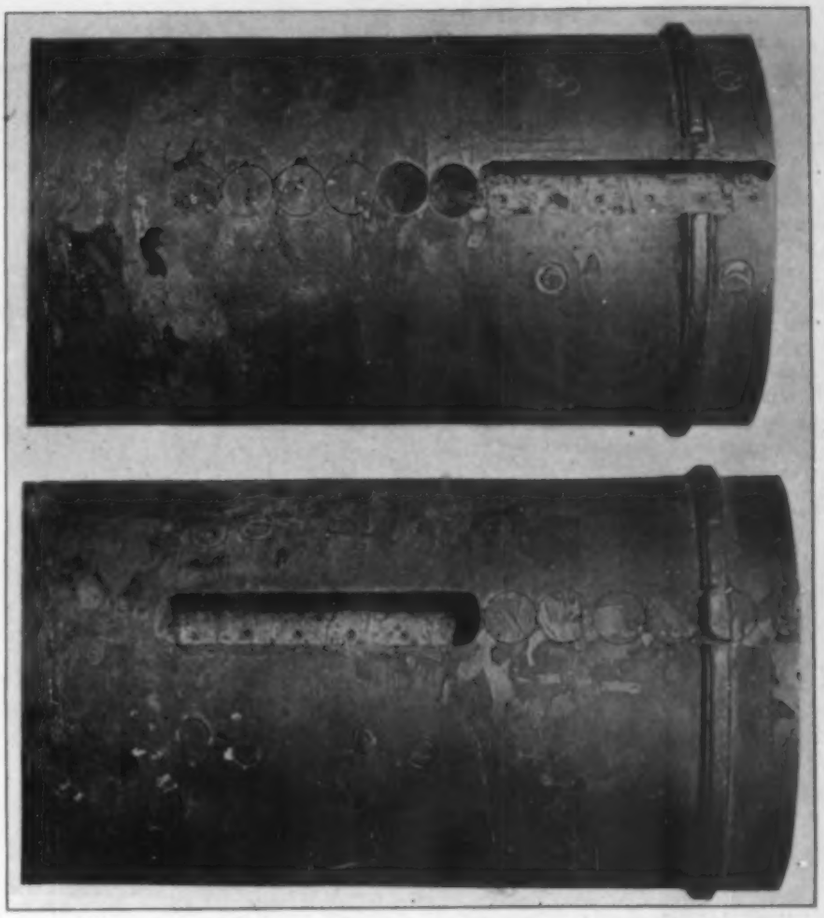


FIG. 8—DRILLED AND PLUGGED HOLES—THE PLUGS WERE LOOSENED AT THE TIME OF QUENCHING

The final state of internal strain in quenched axles which have had their temper drawn will be of lesser magnitude than the temporary state of strain which prevailed at the time of quenching. The steel, however, has had to pass through this severe ordeal and an inquiry into the conditions which attend the process requires an examination of the state of strain caused by the quenching.

From the present axle, after quenching in oil from the temperature of 1,550 degrees Fahr., a disk 7/16 inch long was taken from the end first to enter the oil bath, facing off about 2 inches in length to get beyond the effect of quenching across the end of the piece. Concentric rings were cut from this thin disk and the strains which they displayed were measured and their corresponding stresses computed.

The strains were measured on two diameters. Two of the rings, Nos. 1 and 6, displayed strains of the same amount on each diameter. The greatest variation was shown by ring No. 2, one diameter of which showed an expansion of 0.0009 inch more than the other.

Fig. 5 shows the manner of cutting the disk into concentric rings and graphically illustrates the stresses which were displayed by each. It will

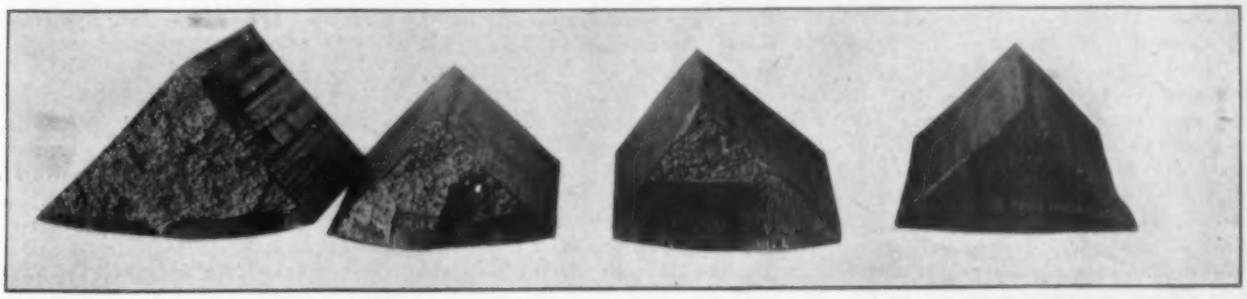


FIG. 7—SEGMENTAL PIECES TAKEN FROM THE AXLE SHOWING INCIPIENT FRACTURES

be observed that the internal strains in a tangential direction were of compression at the exterior of the axle and next the bored hole, while the interior portion was in a state of initial tension.

The stress of compression in the exterior ring was 38,200 pounds per square inch, and in that of the ring at the bore 46,400 pounds per square inch. The maximum tensile stress observed in one of the interior rings, No. 5, was 25,300 pounds per square inch. These values represent the mean stresses in rings 3/16 inch in thickness. The range in tangential stress, of tension and compression, is shown to be 71,700 pounds per square inch.

Characteristics of Test Pieces

The longitudinal specimens, taken from the surface of the axle near the middle of its length, showed strains of compression, the stresses corresponding thereto being 54,600 and 57,000 pounds per square inch, respectively. The strips were taken from opposite sides of the axle. Necessarily some of the interior elements were in a state of initial tension to balance the compressive stresses at the surface. The present observations were not intended to cover the determination of the longitudinal tensions in the interior of the axle. The magnitude of these internal stresses cannot but excite interest.

The momentary state of tension endured by the exterior of the axle at the time of quenching left visible effects. The drilled holes comprising the two groups of six each were permanently distorted. In a tangential direction these holes were permanently elongated about 0.03 inch each. Taken lengthwise of the axle their diameters remain substantially unchanged. The plugs, which were inserted with driving fits, were loosened in the holes. Fig. 8 shows the appearance of the axle at these two groups of drilled and plugged holes.

The failure of this axle presents an additional example of the necessity of securing workmanship of a high order in the machine finishing and fitting of material which is exposed to such situations as those which are occupied by axles, that is, where repeated alternate stresses of tension and compression constitute the work which the steel is required to perform. The demands which are made upon the steel are of a more exacting order in axles than experienced by metal not exposed to reversed stresses. Conditions which do not seem to have pronounced influence on the primitive strength nevertheless are the direct precursors of failure in metal exposed to long continued stresses. The magnitude of the stresses in the service of axles is somewhat indeterminate. From the nature of the work done they are subject to wide fluctuations and without doubt on some occasions reach very high fiber stresses.

Fabrication Strains to be Avoided

The metal of an axle is exposed to severe conditions while in service, and stresses which are incident to service conditions should not be augmented by internal strains of fabrication if they are found to be detrimental. It has been customary, apparently, to consider only those stresses in axles which were due to the external loads coming from the weight of the engine, or cars, as the case happened to be. The internal strains at the time of quenching, during heat treatment, those which result from heavy machine cuts in rough turning, and those which accompany the operation of cold rolling the journals for finishing purposes appear to attain the magnitude comparable to the direct stresses which are caused by the wheel loads.

The internal strains which have been referred to in connection with the heat-treated axle were those having a tangential direction. The longitudinal strains claim rather more attention since the failure of an axle commonly occurs by tension in a longitudinal direction.

The tests were continued, ascertaining the longitudinal strains which were present at the surface of the journal. Two strips, taken diametrically opposite each other, showed the surface metal to be in a state of initial compression, one strip having a value of 33,300 pounds per square inch, the other 28,500 pounds per square inch.

Varied Strains and Stresses

Necessarily, certain parts of the axle were exposed to longitudinal strains of tension to balance those of compression which are located at the surface. In the heat-treated section of the axle which caused the accident there was shown a state of tangential tension in the intermediate zone of metal, between the exterior metal and that which was exposed to the quenching action of the oil at the surface of the bore. It was also shown that coincident surface strains of compression existed in the quenched metal in both tangential and longitudinal directions. This condition in an axle, in which the surface metal is in a state of compression while the interior is in tension, is analogous to the state in which the head of a rail is found. After cold rolling in service strains of compression are introduced at the running surface, increasing such as were acquired during cooling at the time of fabrication. These longitudinal strains of tension in the interior of the axle furnish a contributory cause of interior cracks reported as having been witnessed in heat-treated axles. They are essentially of the same order as the reverse strains of compression in the tops of the heads of rails which lead to the formation of transverse fissures of interior origin. The influence of the exterior metal when in a state of compression is the same, whether in an axle or in a rail, in respect to putting certain of the interior elements into a state of tension. The effect of internal strains may very properly be taken into account when considering the causes of the premature failure of heat-treated axles.

Accident Blamed on Carelessness

In conclusion, it appears that the failure of the axles which occurred under engine No. 1056 was caused by defective metal at the surface of the journal, arising from mechanical injury to the steel, done in the rough turning of the axle. The incipient point of rupture was located in the area of affected metal at the surface of the journal, where numerous short cracks were present and attributable to the roughing out of the lathe tool in turning the forging from which the axle was made. While the direct cause of the fracture of the axle was due to the defective metal of the left-hand journal, other fractures were in progress in the wheel seat of the same end of the axle, which eventually would have resulted in complete rupture in that section. These incipient cracks, which owed their formation to the imperfect fit between the hub of the left-hand driving wheel and its seat on the axle, had extended in the aggregate a distance equal to one-half the circumference of the axle. Evidence of lack of care in the preparation of the axle was shown by the two groups of drilled and plugged holes representing errors in locating the keyways.

Safety Devices for Switch Boards

The electrical industry has been one of the most active in its interest in the safety first propaganda. Close cooperation between the manufacturers and users of electrical equipment has resulted in the development of many devices to safeguard life and property. One of the most prominent developments in the application of safety de-

vices to electrical equipment may be seen on many of the switchboards to be found in large industrial plants. The chief feature of safety measures applied to switchboards embodies the use of grill work or screens, which afford protection against accidental contact with the live parts at the rear of the board. When it is necessary to inspect bus bars, it is now customary to use disconnecting switches between all oil circuit breakers, thus providing a convenient and rapid isolation of the breakers. Another feature of the modern switchboard is the provision which has been made for the insertion of fuse plugs from the front of the board without danger of contact with live parts. Field switches are mounted on the back of the slate panel and are connected to operating handles on the front of the board by rods and bell cranks. This makes it impossible for attendants to be injured by the arc or to come into contact with conductors when operating the switch.

Develops Heat-Resisting Alloy

ONE of the most interesting developments which the research laboratories of the General Electric Co., Schenectady, N. Y., have recently brought out, is a process of impregnating iron and steel with an aluminum alloy. The resulting material, known as insuluminum, is a rich ferro-aluminum which, it is claimed, possesses unusual hardness and heat-resisting qualities. Soon after the process was publicly announced by the General Electric Co., the Diamond Power Specialty Co., Detroit, instituted a series of exhaustive experiments with the new material. These tests, which were of a mechanical and thermal nature, lasted for several months and finally terminated in a trial installation of insuluminum units in soot blowers on a number of different types of water tubes boilers.

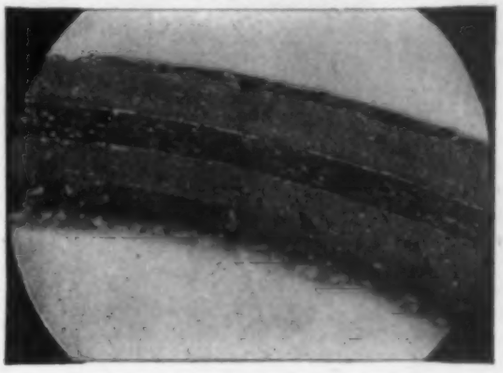


FIG. 1—PHOTOMICROGRAPH OF CROSS SECTION OF CALORIZED STEEL PIPE MAGNIFIED 20 DIAMETERS

The inventor of the process, having in mind the heat-resisting qualities of the product, called the treatment calorizing. The insulating material is not imposed as a coating or skin on the surface of the metal treated, but enters into intimate association with it. As a result of this association, the whole outer region of the body affected changes its composition and a homogeneous alloy is formed. The richness of the alloy is proportional to the depth of impregnation, which, in turn, varies with the length of time of the treatment. The photomicrograph of a cross section of a calorized steel tube, magnified 20 times, shown in Fig. 1, clearly illustrates the diffusion of aluminum into the steel. On the outer and inner surfaces of the tube a thin film of alumina is formed and the thickness of the metal is increased by this amount of alumina deposit. Under this skin a wide band of ferro-aluminum may be seen. In the center, the steel remains unchanged. The even depth of penetration is shown, though the process of cutting the sample accentuated the line of demarcation. One of the first questions arising in connection with the adoption of the alloy to soot blower systems was its ability to withstand the stresses of hard service. The mechanical properties of the material had to be determined with a great degree of accuracy and during the tests of a mechanical nature, the heat-resisting qualities were not observed. It was stated by the research laboratories that the coating produced by calorizing was so hard that considerable effort was required to break through it with a file. To supplement this information and to further prove the mechanical properties, a series of tests were conducted in which the metal was subjected to bending, flattening and hammering processes.

It is claimed that the alloy will resist for an indefinite period a sustained temperature of 1,000 degrees, Cent., or approximately 1,800 degrees,

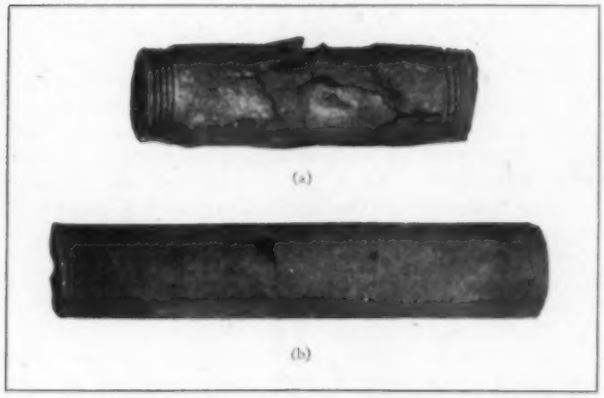


FIG. 2—TESTS SPECIMENS OF PIPE CUT FROM THE SAME STOCK. (b) CALORIZED IRON PIPE; (a) UNCALORIZED IRON PIPE

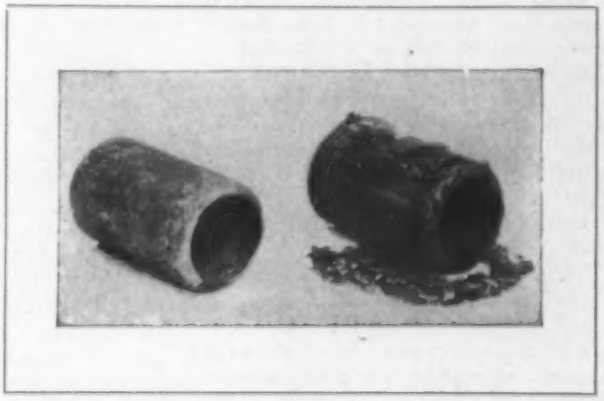


FIG. 3—EFFECT OF 800 DEGREES, CENT., IN A GAS-FIRED FURNACE FOR 100 HOURS ON A SECTION OF CALORIZED AND UNCALORIZED SHEET IRON TUBES.

Fahr. The importance of this statement is apparent from the fact that steel begins to burn, it is believed, at about 370 degrees, Cent., and nickel at 650 degrees, Cent. It is true that both steel and nickel will withstand considerably higher temperatures, but the oxidation of iron and steel becomes pronounced at 500 degrees, Cent., and continues rapidly as the temperature increases.

The performance of calorized iron under test conditions is illustrated in Fig. 2. The two pipes shown in Fig. 2 were both cut from the same stock and the longer section calorized. After the treatment this section of pipe was alternately heated to 1,000 degrees, Cent., in an electric furnace, and then cooled. The total time during which the pipe was subjected to the maximum temperature was about 50 hours. After this test the piece was then heated to 900 degrees, Cent., cooled to a dull red and plunged into cold water. This procedure was repeated three times and at the conclusion of the test, the surface of the test specimen showed no signs of cracking or scaling. The treated pipe and the untreated section were then heated simultaneously with an ordinary blast laboratory lamp. A temperature of 900 degrees, Cent., was maintained for four hours and the specimens cooled and reheated for a like period. At the end of that time the untreated pipe was badly burned and at the point where the flame was applied, the metal was reduced to one-half its original thickness, while the whole surface was blistered. The contrast between the two test specimens was very marked.

FIG. 4—STEEL CAPS AFTER BEING SUBJECTED TO A TEMPERATURE OF 2,500 DEG., FAHR., AND SUDDENLY COOLED—(a) IS INSULUMINUM; (b) IS UNTREATED EXTRA HEAVY STEEL

The comparison between two pieces of sheet iron tube one treated and the other untreated may be clearly seen in Fig. 3. Both of the test pieces were subjected to a temperature of 800 degrees, Cent., for four hours. The experiment was carried on in a gas-fired furnace and at the conclusion of the test, the uncalorized pipe was practically destroyed. Two caps, shown in Fig. 4 are of a type used on soot blowers and were heated for a short period to a temperature of 2,500 degrees, Fahr., and suddenly cooled. The illustration plainly shows the result of this test. The results of a sulphur dioxide test were particularly interesting. Two pieces of pipe, treated and untreated, were run into a furnace at the same time. A temperature of 1,500 degrees, Fahr., was maintained accompanied by an atmosphere of sulphur dioxide. The test, lasting four hours, seriously decomposed the untreated specimen while the treated pipe was scarcely scarred. accompanying illustration.

The oxidation point of insuluminum is said to be about 1,100 degrees, Fahr. If the alumina film is broken down, scaling will set in at a temperature above 1,050 degrees, Cent., but if the film remains intact, the scaling temperature will be considerably higher. The heat resisting qualities of this alloy are said to reduce warping.

Using Waste Heat for Generating Steam

BY WARREN B. LEWIS

THE extraction of waste heat from furnace gases has not always been successful, and the unfortunate examples have been heralded fully as much as the successful ones. Boiler economizers are the most widely-known waste heat extractors; and their success has been due, in no small measure, to a thorough understanding of the characteristics of the gases to be handled. The conditions surrounding steel furnaces have not been so thoroughly understood, nor the requirements of the furnace so well appreciated, so that the apparatus for recovering waste heat has not been standardized.

The writer came in contact with this problem about three years ago, and his recommendation for the installation of waste-heat boilers did not meet with a very enthusiastic reception because the history of the art did not seem to be very encouraging. The fact that a better understanding existed of the transfer of heat from gases to water, did not altogether assure the management of the plant in question; but persistent argument finally led to the adoption of a plan which was eventually carried out and has proved successful.

The only justification for mentioning this case is that the reasoning applied to the problem was somewhat different from that used by Mr. Pratt.

It is true that the velocity of fluids over heated surfaces is a great factor in the transfer rate. It is also true that the greater the velocity, the greater the pressure drop, and that the amount of pressure drop allowable is determined by the cost of producing that pressure drop. Furthermore, the use of a high transfer rate is to reduce the cost of the installation, and the reduction so obtained must be sufficiently great to offset the increased cost of power employed in overcoming the excess pressure drop.

I offer a brief description of a plant using waste heat boilers in which the transfer rate is low, simply because it illustrates the other extreme.

Admitting, at the start, that mechanical draft is practically a necessity, the regulation of draft takes place in the flue between the furnace and the boiler, or, to put it another way, a certain definite draft must be maintained at the end of the checkers. What happens beyond that point is of comparatively small importance.

The furnaces to which I refer were fired with producer gas made from bituminous coal. The amount of coal consumed in a year was 8,400 tons. The gases between the producer and the furnaces were analyzed, as were also the gases between the checkers and the stack; and a determination made of the weight of gas issuing from the stack. The temperature of

A discussion of Mr. Pratt's paper on the "Utilization of Waste Heat for Steam Generating Purposes," which was read at the recent meeting of the American Society of Mechanical Engineers and published in the Dec. 7 issue of *The Iron Trade Review*.

the gases averaged 1,050 degrees Fahr., and the boilers were designed to abstract 550 degrees Fahr. of heat.

The boilers chosen were of the Manning type, with tubes 20 feet long. Draft was produced by means of a motor-driven, steel-plate fan mounted on a platform at the top of the boilers. The Manning type of boiler was chosen because of its freedom from air leakage, the ease with which it can be insulated against radiation losses, and the ease with which the tubes can be kept clean. A rotatable steam-jet tube blower was installed, by means of which the tubes could be blown out as often as desired with a minimum of labor. The ground space occupied was small, and the protection necessary from the weather inexpensive. The boilers were equipped with automatic feed-water regulators.

Calculations Vindicated

The early calculations in connection with this installation, showed that there should be an average output of 212 boiler horsepower. One year after the investigation was made the boilers were in operation. The actual boiler horsepower developed was 227. The temperature of the flue gases was 418 degrees Fahr. The total number of square feet of heating surface was 6,600, and the transfer rate less than 2. The actual power required to drive the fan was about 2½ per cent of the net return from the boilers. The tests showed a comparatively high percentage of recovery, as indicated by the low temperature of the flue gases issuing from the fan.

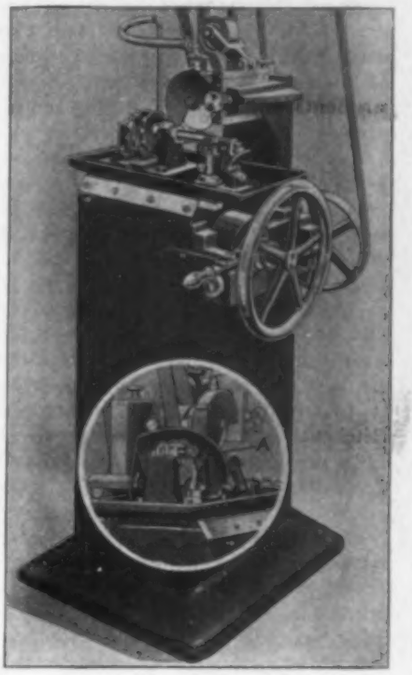
This case is not cited to oppose Mr. Pratt's arguments, but simply as an example of what has been accomplished from a different reasoning point. In order to recover a high percentage of heat with a low transfer rate, a large amount of surface must be used; and it is simply a question of what that additional surface costs as compared with the cost of a high pressure drop.

Ford's Tonnage

President Harry R. Jones, of the United Alloy Steel Corporation, Canton, O., advises us that the statement made recently in connection with the injunction proceedings against the Ford Motor Co., that it was taking the entire production of the Canton company, is untrue, as the latter company is shipping to the Ford Motor Co. in the way of vanadium steel, nickel steel and common carbon steel less than 20 per cent of the tonnage which it makes.

Develops Automatic Hob Grinding Machine

The H. E. Harris Engineering Co., Bridgeport, Conn., has recently developed an automatic machine for grinding hobbing cutters. This tool, shown in the accompanying illustration is said to embody a number of features which are new in equipment of this character. The wheel spindle is mounted on ball bearings on a horizontal slide which may be adjusted axially or perpendicularly by means of micrometer screws. By means of an extra attachment the machine will grind either right or left hand spirals as well as straight fluted hobs. The



AUTOMATIC HOB GRINDER

table is actuated by a cam and shaft contained in the body of the machine. This shaft is operated by a belt-driven worm wheel. The indexing is entirely automatic and is operated by means of the shaft which drives the table. The indexing mechanism, which is clearly shown at *A*, is covered by a hood in order that no grit or grinding compound may affect it.

The Valley Mold & Iron Co., Sharpsville, Pa., in November made 29,562 tons of ingot molds, the largest tonnage produced by that concern in a 30-days' period.

Waltz & Co. is the title of a new company just organized, with offices at 50 Church street, New York, to engage in the metal business. The company is a producer of brass ingots and billets, casting copper, aluminum ingots and aluminum and bronze powders. In addition, it is a large buyer of brass and aluminum scrap and deals in all metals. Its officers are well known in the metal trade in New York and throughout the country. They are: President and treasurer, J. L. T. Waltz; vice president, A. S. Neuburger, and secretary, Charles P. Verkruzen.

Sold Entire Road

Chicago, Dec. 26.—The entire physical property of the Chicago, Anamosa & Northwestern railroad has been sold to Great Britain for use in the war zone. The railroad is 33.3 miles long, and its equipment consists of three steel bridges, its track, three locomotives, two baggage and passenger cars and six freight cars. The sale followed recent arrangements by Great Britain to ship rails from Canadian roads for use in France. The sale was made by Herman Sonken, president of the company, and a member of the firm of Sonken, Calamba & Co., large dealers in second hand railway material and scrap. The railroad equipment will be shipped to France as soon as it can be taken up.

Nail Works Expands

The Diamond Tack & Nail Works, Boston, has purchased the business of Patrick E. Somers, tack manufacturer, 35 Lagrange street, Worcester, Mass., and will operate it in connection with its other plants. Mr. Somers has been offered the position of president, a director and general superintendent of all the plants of the Diamond Tack & Nail Works, which he has under consideration. He had been in business 20 years and had one of the best equipped plants of its kind in New England.

The Illinois supreme court has handed down a decision upholding the amended section of the workingmen's compensation law, which provides for review in the circuit court of awards by the industrial board. The decision affirms the opinion of the Cook county circuit court and establishes the constitutionality of the new section.

The Forest City Wire Works, Rockford, Ill., which recently increased its capital stock to $150,000, has bought the business of the Roseland Can & Specialty Co. The plant occupied by the Roseland Co. has been leased by the new owners and the business will be continued at the same place.

Finish Important Improvements

Youngstown Sheet & Tube Co. Increases 1916 Construction Appropriation From $5,000,000 to $12,000,000—Output is Now 30 Per Cent Larger—Extensive Development Program Outlined for 1917

IN THE Jan. 6, 1916 issue of *The Iron Trade Review,* attention was called to the extensive construction program proposed by the Youngstown Sheet & Tube Co., Youngstown, O. In the year that has since elapsed the original plans have been greatly modified and enlarged. By the close of 1916 approximately $12,000,000 had been expended on new construction. The original appropriation called for only $5,000,000 for the construction of a by-product coke plant, the erection of bar mills, etc. Important improvements have been effected during the year now closing and a considerable amount of construction work is still in progress. The extensions and improvements completed during 1916 were planned to a large extent for the purpose of promoting economy and securing efficiency, but they will also increase the output of the works approximately 30 per cent.

Among the more important units built under this program and now in service are a by-product coke plant of 204 Koppers ovens, with a rated capacity of 825,000 tons of coke per year; benzol and by-product recovery plants erected by the Semet-Solvay Co., with capacity sufficient for handling the gas produced by the by-product ovens; one 18-inch skelp mill with necessary auxiliaries and equipment; three 100-ton open hearth furnaces, bringing the number of furnaces in service to nine; an addition doubling the capacity of the open hearth stock house with the necessary crane and other equipment; a new power station at the rod and wire department, equipped with four 768-horsepower Babcock & Wilcox boilers, Riley stokers, a Helander condenser and three 1,500-kilowatt geared turbo-generators; and a new works office building, with 57,800 square feet of floor space.

The new office is designed to accommodate the executive and clerical force directly connected with the operating department. The general offices of the company, including the sales department occupy the third floor of the Stambaugh building in the city of Youngstown. The new office building is equipped with a complete modern restaurant with a capacity of 350 noon meals per day. It is operated on a cost basis as a convenience to the clerical and executive forces of the works.

A new laboratory building with floor space 7,140 square feet has been completed. This building is divided into four main laboratories, each serving one of the general divisions of the works. The routine laboratory work for the coke plant, however, is not handled in this building, a special laboratory of adequate capacity having been erected at the coke plant itself. Quarters for the chemical, metallurgical and inspection departments are provided in this building.

An emergency hospital, located at the main north gate of the works, equipped with every facility for medical, surgical and welfare work also has been provided.

Work Almost Completed

In addition, an ore bridge with extensive improvements to the facilities for handling stock has been installed at the furnaces of the Andrews & Hitchcock Iron Co. at Hubbard, O. This company was acquired by the Youngstown Sheet & Tube Co. early in the year.

Work on the original 1916 program remaining uncompleted consists of one 9-inch Morgan continuous bar mill and one 12-inch Morgan continuous bar mill. The 9-inch mill has a continuous roughing train of six stands and a continuous finishing train of six stands, together with one Edwards sizing mill. The roughing mill will be driven by a 37 x 48-inch Nordberg unaflow engine. Two stands of finishing rolls will be driven by a 700-horsepower direct-current Crocker-Wheeler motor. Four stands of finishing rolls will be driven by two 600-horsepower direct-current Crocker-Wheeler motors. The sizing mill will be driven by a 100-horsepower direct-current Crocker-Wheeler motor. The 12-inch mill will have a continuous roughing train of five stands and a finishing train of two stands. The capacity of this mill under normal conditions should be 10,000 tons of average sections per month. This mill will be driven by a 4 x 50-inch Nordberg unaflow engine.

The 9-inch mill building is 90 x 1,150 feet. The 12-inch mill building is 100 x 401 feet. The 9-inch and 12-inch mills are served by two 15-ton cranes. One 15-ton crane will be installed in the billet yard with another of the same size in the warehouse.

The 1,300-ton mixer plant begun during 1916 will not be completed for some time. This mixer plant will be used exclusively by the open hearth department, leaving the present plant entirely at the service of the bessemer department.

The extension program for 1917 has been already begun by the starting of work on three additional open hearth furnaces of 100 tons capacity, which are expected to go into service early in April. In addition to these furnaces, four additional pit furnaces are being constructed, two of which are for use in the open hearth and two in the bessemer department. A new building equipped for stripping ingots will be erected and provided with sufficient capacity to take care of all the open hearth and bessemer production. Considerable additions are being made to the finishing capacity of the tube mills, mainly in the extension of threading floor facilities.

Plans for a new locomotive repair shop, equipped with cranes and other necessary machinery, are being prepared in the engineering department, and this building will be erected during the year. A storage house to contain machinery parts and other material is in course of erection. This building will be 300 x 400 feet. A new cinder yard with cranes and other necessary machinery is under construction. The cost of the foregoing items, together with other minor changes and improvements authorized for 1917 is estimated at approximately $4,000,000. An additional blast furnace of 500 tons daily capacity has been authorized. Construction work has not been commenced.

The Ellicott ship yards, Baltimore, leased six months ago for a period of 2½ years by the Riter-Conley Mfg. Co., a subsidiary of the McClintic-Marshall Co., Pittsburgh, is being operated at maximum capacity. The Riter-Conley company has the privilege of purchasing the plant at the expiration of the lease. The company is now building two ships, 233 x 38 x 23 feet, and is filling contracts for a number of smaller vessels.

News of Employers and Employes

Many Increases in Wages—Giving of Insurance Policies Increasing in Popularity—Many Manifestations of Good Will

MANUFACTURERS throughout the United States are generous to an unprecedented degree during the present holiday season. In countless cases, wages have been advanced, bonuses distributed, insurance policies presented to employes and many other manifestations of good will shown.

Life insurance policies and profit-sharing premiums to the approximate value of $1,000,000, were distributed today to 900 employes of the Sperry Gyroscope Co., Brooklyn, manufacturer of gyro-compasses, ship stabilizers and high-intensity searchlights, inventions of Elmer A. Sperry, member of the naval advisory board. The profit-sharing premiums cover a period from Oct. 1 to Dec. 31, but will be continued in the future, according to the announcement. The individual amounts were determined according to a sliding scale, depending upon the length of employment; but include all employes, whether they had been with the Sperry company five years or longer or only three months.

The American Brass Co., with plants in Waterbury, Ansonia and Torrington, Conn., announces that in addition to the bonus of 10 per cent paid to its salaried employes during 1916, an additional bonus of 25 per cent will be paid in December. In addition, 10 per cent will be added to the salaries of employes for 1917, and all other employes will receive a straight advance of 2½ cents per hour, and adjustment of piecework rates will be made as will be equitable.

The Peck & Young Co., Bristol, Conn., maker of springs and machine screw products, has adopted a profit-sharing plan with its employes. From Oct. 15 to Dec. 15 they will receive an extra stipend of 10 per cent on their wages. This will continue every two months until further notice.

The Wallace Barnes Co., Bristol, Conn., maker of springs, gave its 600 employes an extra week's pay as a Christmas present.

The Stanley works, New Britain, Conn., distributed a Christmas bonus to 300 of its office and factory employes. It was based on a percentage of the annual salary of the recipient.

The Wyman-Gordon Co., Worcester, Mass., distributed a Christmas bonus of $15,000 to its 600 employes, ranging from $5 to $50 each. The employes showed their appreciation for Thanksgiving and Christmas gifts by presenting George F. Fuller, president, and Harry G. Stoddard, vice president and general manager, with silver loving cups, and George Hathaway, general superintendent with a reading lamp.

Women Workers

Dayton, O., Dec. 26.—Women are beginning to be serious rivals for men's jobs in factories here. Following the walkout of Dayton machinists in August, manufacturers began putting women to work at machines. The new workers proved so efficient in their new line of endeavor that factory heads will keep the strike-breakers at work.

Theoretically, the machinists' union is still holding out for an eight-hour day, time and one-half overtime and double time for holidays. In reality, the strike died a natural death. In only a few of the smaller factories were the demands of the men met.

The Recording & Computing Scales Co., is one of the big concerns to employ women on the hand presses now. Men still do the lifting, but the women are actually doing the delicate work in Dayton factories. The manufacturing concerns are opening their plants more and more to women labor.

"Women are better fitted for delicate work," is the explanation given for supplanting men labor with women labor. "They are much more industrious and seldom shirk. The only drawback is that women know little of machinery. This difficulty will be met in time."

Wage Dividend

An interesting plan of wage-dividend disbursements to its employes to enable the latter to meet the high cost of living and to reward them for their loyalty, has been announced by the Doehler Die-Casting Co., manufacturer of dies, which operates factories at Brooklyn, Newark, N. J., and Toledo. Whenever the company declares its regular quarterly dividend on its stock, it will also declare a wage dividend amounting to 10 per cent per annum to all its employes based on wages actually received, including piecework and overtime. The system is effective Jan. 1, 1917.

Announcement of the plan was made by H. H. Doehler, president and general manager of the company, at a complimentary dinner at Brooklyn recently tendered to the Doehler Executive Club, which is composed of all the executive heads of the Doehler Die-Casting Co. The conditions governing the payment of these wage dividends are set forth as follows:

"An employe must be in the employ of this company without interruption for a full year before he can participate in the wage dividend. Upon completion of a full year's employment he automatically becomes a candidate for this wage-dividend. His wage-dividend will be calculated from the date of completing the first year's employment to the date of declaration of dividend.

"This wage-dividend when declared will be applied as follows:

"First—Will be paid in full to all employes who have been in the employ of the company for a full period of three years or more.

"Second—Two-thirds will be paid to all employes who have been in the employ of the company for a full period of two years and less than three years.

"Third—One-third will be paid to all employes who have been in the employ of the company for a full period of one year and less than two."

It is also announced that effective Jan. 1 all employes who have been working 50 hours during the week will be put on a 48-hour week at the same pay. Mr. Doehler stated that in his opinion eight hours per day was sufficient for all men who worked. The Doehler Die-Casting Co. employs 1,200 men and has a weekly payroll of approximately $25,000.

It required 4,300 turkeys, or three carloads, to meet the requirements of the Norton Co., Worcester, Mass., for its annual distribution among employes at Christmas time. Of this number 3,500 were given away at its plants in Worcester, the remainder being sent to its branch plants and offices in various parts of the United States and Canada. The turkeys averaged 10 pounds each and cost the company 32 cents a pound. It was the largest number ever distributed.

Large Increase

In Capacity of Interstate Iron & Steel Co. by Purchase of Plants

Chicago, Dec. 26.—The purchase of all the property and business of the Grand Crossing Tack Co. is announced by the Interstate Iron & Steel Co. The former will be consolidated with and merged in the business of the Interstate company.

The present property of the Interstate Iron & Steel Co. comprises rolling mills at East Chicago, Ind., and at Marion, O. The acquisition of the former Grand Crossing Tack Co. will give the Interstate company, in addition, an open hearth steel plant containing two 40-ton open hearth furnaces and a 35-inch blooming mill at South Chicago on 118th street, and a wire plant at Grand Crossing. The new owners will immediately erect two 60-ton open hearth furnaces at the 118th street works, these being the furnaces that were to have been erected at East Chicago. Most of the equipment and material is ready for this work, and the new open hearths probably will be in operation by April, 1917.

It is announced that Samuel Hale, formerly connected with the Wisconsin Steel Co. at South Chicago, will be associated with the Interstate Iron & Steel Co. in an executive capacity.

The property of the Grand Crossing Tack Co. consists of two plants. The South Chicago works, which was built in 1902 contains two Wellman 40-ton open hearth furnaces, two 4-hole soaking pits, and a 35-inch blooming and billet mill with gas producers and a machine shop. The annual capacity of this plant is 50,000 tons of ingots and 45,000 tons of small billets. At Grand Crossing there is a wire rod mill and a wire and wire nail plant, including a Morgan continuous heating furnace, a continuous wire rod train, 70 wire drawing blocks, 80 wire nail machines, 30 cut nail machines, and a wire galvanizing pot.

The product of these plants includes wire rods, wire nails, staples, barbed wire, fencing, rivets, tacks and iron and steel cut nails. The annual capacity is about 45,000 tons of wire rods, 30,000 tons of wire, 300,000 kegs of wire nails, 3,000 tons of rivets, 1,500 tons of tacks, 500 tons of staples, and 30,000 kegs of cut nails.

The Trans-Continental Freight Bureau has made a concession in export rates on tin plate from Pittsburgh and eastern points destined for points in British Columbia. R. H. Countiss, agent for the bureau, has been instructed to notify shippers that the 50-cent rate now obtaining, which was to have been advanced to 60 cents Jan. 1 will continue until further notice.

Cleveland Crane Plan

During the past seven years employes of the Cleveland Crane & Engineering Co., of Wickliffe, O., have been receiving checks from the company representing a share of the profits of the year distributed as a bonus for faithful service. It has been figured on a percentage basis.

Under this system, 3,000 hours have been taken as a year's work and to each employe who has not been absent from work more than one day each month during the year, 1 per cent of his yearly wages has been paid for each full year that he has been in the employ of the company. A man who has been with the company for seven years receives 7 per cent of his yearly wages.

The employes were made happy this year by an announcement from C. C. Robbins, general manager of company that on account of the increase of this year's business over that of last year, the bonus percentage will be increased 100 per cent. The majority of the employes will be eligible for benefits this year.

A number of the old employes will receive checks that represent 20 per cent of their wages for this year.

Will Move

Perth Amboy, N. J., Dec. 26.—The R. G. Packard Co. recently acquired a site here to which it proposes to move its ship building business. The plant at present is located at Bayonne, N. J., but the Packard company recently sold its property there to the Standard Oil Co. and must vacate it by Feb. 1.

To Increase Capital

The directors of the Colt's Patent Fire Arm Mfg. Co., Hartford, Conn., have voted to apply to the incoming legislature for permission to increase its capital stock. The company is at present capitalized at $2,500,000. While no amount was determined upon for the increase the sum of $10,000,000 was mentioned at the meeting. The reason given for the proposed increase is that the company is growing fast and much new property is being accumulated. The power to increase will be sought in order that, as circumstances warrant, the stockholders, by a two-thirds vote, may increase the capital stock as it is needed. The limit of $10,000,000 is suggested, inasmuch as the directors favor application for an amount sufficiently large so that it will be unnecessary to apply again for some time. The company has a surplus estimated between $10,000,000 and $15,000,000 and has been erecting new buildings to accommodate its growth.

Given Choice

The Brown & Sharpe Mfg. Co., Providence, R. I., has offered to its 4,750 employes a choice of taking insurance either on the one year renewable term plan, or on the pension insurance (to age 65) plan. Giving employes more than one option to elect from is something new in the group insurance business. The premiums are paid by the employe to the employer, but the employer has arranged to pay on the pension insurance plan a certain percentage of the premium, depending on the years of service. On the one year renewable term plan, the employer has agreed that, although the rates on this plan increase as the insured grows older, the employer will co-operate with the employe to the extent of paying the increase in the rate from year to year, so that the employe continues to pay the premium for his age at the time of taking out his insurance, as long as he remains in the employ of the Brown & Sharpe Mfg. Co. It is not compulsory on any employe to take either kind of insurance. Altogether on both plans there is $516,000 insurance in force already.

Personals

S. B. Taylor, sales manager of the S K F Ball Bearing Co., of Hartford, Conn., has been appointed vice president of the company succeeding F. B. Kirkbride, who remains on the board of the company. Mr. Taylor will remain in charge of sales. G. A. Ungar, former representative of the company in Cleveland, Detroit and Pittsburgh, has been appointed technical manager and chief engineer, succeeding Uno Forsberg, who returns to Sweden after completing his work of creating the manufacturing organization of the S K F Ball Bearing Co. in this country.

J. E. Johnson Jr., consulting engineer and metallurgist, 52 William street, New York, will sail from Vancouver Dec. 28 on the steamship Asia for Shanghai. Mr. Johnson will remain in China for approximately four months on professional business.

Iron and Money: Fact and Comment

Important International Developments Overturn Stock Speculative Structure—Steel Shares Drop Sharply Although Iron and Steel Markets Unaffected by Stirring Events

INTERNATIONAL developments of standing import cast their shadow over the security markets in the days immediately preceding and following Christmas. A little over a week ago, Germany dispatched its surprising note to neutral powers, announcing willingness to discuss peace terms with the entente powers. Then like a bolt from a clear sky, came President Wilson's note addressed to all belligerents, requesting a statement of what the various powers were fighting for and asking for statements of their positions. On the heels of Mr. Wilson's note came an explanatory note from Secretary of State Lansing, who intimated that the United States was on the verge of war and that for this reason the President had taken action. On the same day, however, Mr. Lansing issued another note practically retracting what he had previously said, expressing fear that his statement was being misconstrued. A few days later, the government of Switzerland sent notes to the warring powers, supporting the stand of the United States, to be followed closely by Sweden, with every prospect that all other neutral powers would fall into line with the United States.

Wilson's note gave the stock market cold chills and hurried selling ensued; but Lansing's first statement was a bombshell in earnest and the second was unable to undo the damage done. The top-heavy speculative pyramid toppled over. On Thursday last, 3,176,000 shares were bought and sold and prices crumbled. Speculators all over the country hurried to dispose of their holdings, and the result was one of the biggest days in the history of the New York stock exchange, while the monetary loss was greater than on any previous day.

In the course of a week, United States Steel common tumbled from about 127 to 101, in the panic of selling. Later it recovered part of this loss, as certain large interests displayed sanity. The course of the stocks of the independent steel companies was much the same. Peace, however much to be longed for, is considered by Wall Street as having dread significance. In the meantime, the iron and steel markets have been unaffected by the peace talk and activity proceeds, hindered only by the limitation of transportation facilities.

Quotations on a number of iron, steel and industrial stocks at the close of the New York stock exchange Dec. 23 and net changes for the preceding week follow:

	Close Dec. 23.	Net chg.
American Can	46⅞	—5
American Can, prfd.	108	—1¼
Amer. Car & Fdy.	64¾	—4⅞
Amer. Car & Fdy., prfd.	116¼	+ ¼
American Locomotive	78¾	—4⅞
American Locomotive, prfd.	104⅜	—1⅜
American Steel Foundries	62	—2½
Baldwin Locomotive	58½	—11
Baldwin Locomotive, prfd.	100½	—2½
Bethlehem Steel	503	—72
Bethlehem Steel, prfd.	130	—15
Colorado Fuel & Iron	45	—2½
Continental Can	86	—2½
Continental Can, prfd.	112	—1
Crucible Steel	58	—10¾
Crucible Steel, prfd.	113⅜	—1⅜
General Electric	167⅜	—5⅛
Gulf States Steel	125	—15
Gulf States Steel, 1st prfd.	107	—1
Gulf States Steel, 2nd prfd.	108½	+ ½
International Harv. of N. J.	121	⅜2¼
Internat'l Harv. of N. J., pr.	120	.....
Internat'l Harv. Corp.	87	+6
Internat'l Harv. Corp., prfd.	114⅛	+ ⅛
Lackawanna Steel	83½	+ ½
Nat'l. Enamel'g & Stmp. Co.	27½	—5⅛
Nat'l En. & Stmp. Co., prf.	93½	—5¼
Pressed Steel Car	76½	+ ¼
Pressed Steel Car, prfd.	102¼	+ ⅛
Pullman Palace Car	162	—2¾
Republic Iron & Steel	76⅜	—4⅜
Republic Iron & Steel, prfd.	104	—1
U. S. C. I. P. & Fdy. Co.	20¼	—1⅜
U. S. C. I. P. & F. Co., pr.	60¾	+ ⅜
United States Steel	106⅛	—8
United States Steel, prfd.	120	+1
Westinghouse Mfg.	55⅞	+ ⅜

Earnings of Steel Companies

The United Alloy Steel Corporation, recently financed to take over the United Steel Co., Canton, O., on Oct. 25, has net assets of $14,730,015, equal to $29.40 a share for the 300,000 shares outstanding. Excess of quick assets over current liabilities on that date was $6,491,644. The condensed balance sheet follows:

ASSETS.

Plant	$7,461,473
Cash and receivables	6,554,630
Inventories	2,448,622
Investments	812,500
Prepaid expenses	14,320
Total	$17,291,546

LIABILITIES.

Accounts payable	$2,443,530
Accrued accounts	68,078
Reserves	59,924
For stock, no par	14,730,015
Total	$17,291,546

The asset valuations in the above statement are the old book values of the preceding company and are on a most conservative basis. The figures of the American Appraisal Co. are substantially above the book values.

The statement of the Transue & Williams Steel Forging Corporation as of Nov. 30 shows net assets for the 100,000 shares of stock of $2,983,115, or $29.83 a share. As in the case of the United Alloy company, this statement is made on the basis of the conservative book values of the old Transue & Williams Co., which were placed higher by a valuation of the American Appraisal Co. Working capital as of the date given was $1,817,381, or $18 a share.

The balance sheet as of Nov. 30 is presented below:

ASSETS

Plant	$936,025
Cash and receivables	1,891,140
Inventory	556,567
Other assets	229,607
Total	$3,613,441

LIABILITIES:

Current liabilities	$630,326
For stock, no par	2,983,115
Total	$3,613,441

Voted to Sell

The stockholders of the Hendee Mfg. Co., Springfield, Mass., at a special meeting Dec. 15, voted to authorize the directors to sell its factory building in East Springfield, Mass., and also the company's interest in the Harley Co., Springfield, Mass., brass founder. The object of the sale is to concentrate the business by which all work now done in the East Springfield plants will be done in the central factories in Winchester square, Springfield. The directors have several offers under consideration, one of which is made by a group which proposes the incorporation of a company under Massachusetts laws to take over the East Springfield properties and manufacture wire automobile wheels. The property is valued at $750,000.

Frank H. Oldershaw, former city engineer of New Britain, Conn., has accepted a position as architect and engineer with the Underwood Typewriter Co., Hartford, Conn., and will begin his duties the first of the year.

The new rules and regulations governing work in iron foundries in Massachusetts have been issued by the state board of labor and industries. They will go into effect on Saturday, Jan. 13.

Tool Market Maintains Even Gait

Union Pacific Railroad Issues Heavy List of Equipment Which Will Be Purchased at Once—Foreign Orders Appear in Scattered Lots—Domestic Business Continues to Provide Bulk of Contracts

THE machine tool market, despite the interruption of the holiday season and the developments calculated to bring the European war to a speedy end, reflects a fair amount of activity, although the volume of business is not as large as in preceding weeks. The leading event is the issuance by the Union Pacific railroad, from its office at 165 Broadway, New York, of one of the largest inquiries that has come out from the railroads this year. The list involves all kinds of punching and shearing machinery and a general locomotive shop equipment, and is comprised in several inquiries, not all of which formally have been issued. The most satisfactory feature of the list is that its distribution is to be effected without delay, a fair proportion of the requirements involved; in fact, already has been placed. A sprinkling of foreign orders also has been a feature of the market during the week. These inquiries came principally from the belligerent powers.

An inquiry that recently was put out by the Singer Mfg. Co. for 700 screw machines for export to England has been dropped. Demand for small requirements continues to come from domestic concerns in diversified lines of industry. A number of concerns are believed to be about ready to come into the market. These include the Kent Motors Co., which is building an automobile plant at Belleville, N. J. This concern is getting ready to send out inquiries for machine tools, from its New York office, 1790 Broadway. The Witteman Air Craft Co., Stapleton, Staten Island, N. Y., is locating a new plant in Newark, N. J., and is expected to enter the market. The New York Aero Construction Co., in which Harry H. Picking East Orange, N. J., is interested, is locating a plant in Newark, for which some equipment is to be bought.

Industries Plan Many Extensions

A. Allan & Sons, 482 Greenwich street, New York, makers of red metals, are about to locate a plant at Harrison, N. J. The Standard Underground Cable Co. is adding to its plant at Perth Amboy, N. J. The Newark Rivet works, Newark, N. J., is about to erect an addition. Cyrus Currier & Son, Newark, N. J., are about to erect a steel foundry shed. The Widemann Machine Co., Philadelphia, is about to erect a new machine shop. The General Ordnance Co., Derby, Conn., is erecting large additions, which are expected to double its capacity. The Capitol Construction Co., Washington, has let a contract for the erection of an automobile repair shop. The Merrick Scale Co., Passaic, N. J., will erect a shop building. The Gilbert & Barker Mfg. Co., Springfield, Mass., has let a contract for an addition to cost about $300,000. The Quality Saw & Tool Co., Springfield, Mass., is about to extend its capacity. The Talbot Engine Co., New York, has leased the old Lozier motor plant at Plattsburg, N. Y., for the manufacture of boilers and engines. The Turner Machine Co., Danbury, Conn., is completing the erection of an extension. The United States Metal Mfg. Co., Norwich, Conn., has leased additional property and is expected to extend its capacity.

An important order for cranes last week was divided by the Bethlehem Steel Co. between the Alliance Machine Co., the Morgan Engineering Co., and Pawling & Harnischfeger Co. This order involved one 250-ton, one 100-ton, and a number of smaller cranes. The Bethlehem company is expected shortly to distribute an order for about 15 cranes for its Sparrows Point, Md., plant. The cranes just placed are for installation at South Bethlehem, Pa.

Chicago Market Active

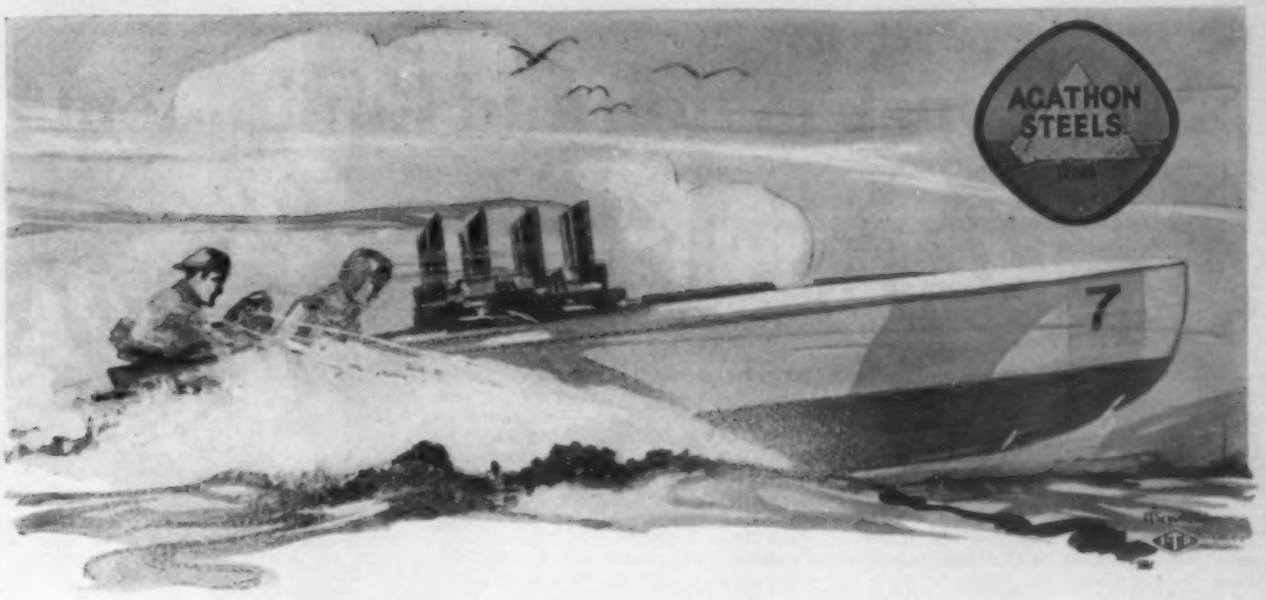
INQUIRY for and sales of machine tools continue to be excellent, although on a somewhat slower scale than has prevailed for several weeks. Usually at this season there is a slight let-up, which is not as marked this year as usual. November established a new record for sales which December scarcely will equal. An inquiry has been received by dealers here, involving about 200 machines for export, but not much is known about its proposed destination. The class of machinery indicates that it is to be used for equipping a munition plant and includes lathes, automatic screw machines and special machinery. The Hanna Engineering Co. has an inquiry out for three or four electric traveling cranes of 20 tons and less capacity. The Utah Copper Co. is inquiring for 10 second-hand tools.

Pittsburgh Buyers Cautious

THE machine tool and heavy rolling mill equipment market in Pittsburgh is quiet, as usually is the case during the holiday season. A number of interesting negotiations for machinery are pending, but none of them likely will be closed until after Jan. 1. While dealers declare that talk of peace abroad has not affected the market, it is apparent that both buyers and sellers have been moving much more cautiously than previously. The Bethlehem Steel Co., which recently awarded contracts for about 50 electric cranes of various lifting capacities, now is negotiating for additional cranes and rolling mill equipment, orders for which may be placed within the next fortnight. The Carnegie Steel Co. continues to buy equipment for its new bar mill at McDonald, O. Reports that the Jones & Laughlin Steel Co. had opened negotiations for a large rod mill are denied.

Cincinnati Market Slowing Up

TRANSACTIONS in the Cincinnati machinery market are slower, due to the holiday season. The shortage of natural gas has handicapped operations in a number of cases, but no local plants have been forced to shut down because of the lack of gas supply. An advance in the price of machine tools is looked for in the near future, due to constantly advancing prices on castings and semi-finished and finished steel products. Peace talk has caused several machine toolmakers to withhold extensions to their plants.



Carefully the manufacturer built the engine. Only the highest grade materials, he used.

Mile after mile the engine raced the boat through the storm—it stuck tight to its job—it needed no attention.

The manufacturer's reputation was made.

AGATHON STEELS

"AGATHON" Chrome Nickel
"AGATHON" Chrome Vanadium
"AGATHON" Nickel Steels
"AGATHON" Vanadium
"AGATHON" Chrome Steel
"AGATHON" High Carbon
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AGATHON STEELS are made specially for those manufacturers that are ***"out for a reputation."***

They are made for the particular users of steel who must supply a particular trade.

Just tell us what you make and we will tell you which steel to use. There is a specially prepared AGATHON STEEL for any of the following purposes:

Connecting Rods, Crank Shafts, Driving Shafts, Pistons, Cams, Gears, Springs, etc.

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MASSILLON, OHIO

BRANCH OFFICES:

Detroit Office: 326-27-28 Ford Bldg., F. Walter Guibert, District Representative
Cleveland Office: Hickox Bldg., The Hamill-Hickox Co., District Representative
Chicago Office: Room 1511-12 Lytton Bldg., 14 East Jackson Blvd., A. Schaeffer, District Representative
Philadelphia Office: 902 Widener Bldg., Frank Wallace, District Representative
J. E. Dockendorff & Co., 20 Broad St., New York, N. Y., General Export Agents

New Construction and Equipment

What it is **Where it is** **Who's doing it**

Among New England Factories

BOSTON.—The American Tin Plate Co. has been incorporated with $100,000 capital by Eugene H. Taylor, Charles Leighton and Frank E. Johnson.

BOSTON.—The New England Fireproof Construction Co. has been incorporated with $150,000 capital by Robert M. Dobbins, T. Bradley Luce and G. Bertram Washburn.

NEW BEDFORD, MASS.—Plans are being figured for a concrete, 2-story and basement factory building and a 2-story power house for the Continental Wood Screw Co., Mt. Pleasant.

PITTSFIELD, MASS.—The General Electric Co. will build three additions to its plant within the year, one of which will cost $100,000.

WEBSTER, MASS.—J. B. Prescott & Son, founders, will build a concrete, 4-story manufacturing plant adjoining their property for their own use.

PROVIDENCE, R. I.—The Birchall Mfg. Co. has been incorporated with $100,000 capital by George A. Bertsch, William D. Nisbet and Alfred P. Ward.

BRIDGEPORT, CONN.—The Standard Oil will build a 40 x 130-foot office building, stable and warehouse on Admiral street.

MERIDEN, CONN.—The Foster, Merriam & Co., maker of cabinet hardware, has increased its capital stock from $240,000 to $320,000.

NEW BRITAIN, CONN. — The Stanley Works has taken out a permit to erect a frame, 60 x 160-foot factory building off Curtis street.

From the Alleghenies to the Sea

BUFFALO.—The Utility Machines Co. has been incorporated with $100,000 capital by Louis J. Bennett, H. W. Young and Leslie J. Bennett.

BUFFALO.—The Demarest Heating Corporation has been incorporated with $10,000 capital to manufacture furnaces, stoves and ranges, by W. S. Harrison, John Demarest and G. W. Bartlett.

BUFFALO.—The Corson By-Product Coal Corporation has been incorporated with $300,000, to deal in coke, coal, by-products, blasting powder and high explosives, by E. A. Roberts, A. A. Engle and G. A. Corson.

BUFFALO.—The general contract for the erection of the $200,000 plant for the United States Alloys Co. has been let to the Lackawanna Bridge Co. Plans call for the erection of four 1-story buildings, 55 x 135 feet, 40 x 90 feet, 32 x 90 feet and 32 x 62 feet, respectively.

ELMIRA, N. Y.—The Elmira Foundry Co. has been incorporated as founder and machinist with $300,000 capital by S. G. H. Turner, A. M. Louden and J. E. McCann.

LEROY, N. Y.—The Lapp Insulator Co. has been incorporated to manufacture electrical and mechanical apparatus with $150,000 capital by S. Levy, H. W. Rippey and J. B. Abbott, Geneseo.

ATLANTIC CITY, N. J. — Charles Parke will erect 1-story brick factory, 65 x 110 feet.

BOUND BROOK, N. J. — Alpha Chemical Works has been incorporated to manufacture and deal in chemicals and dyes with $100,000 capital, by Robert Vom Cleff, George W. Study, New York; Lester C. Burdett, Palisade, N. J.

CAMDEN, N. J.—Chemical Products Corporation has been incorporated to manufacture and deal in chemicals, pharmaceutical and medical preparations with $200,000 capital, by F. R. Hansell, John A. MacPeak, I. C. Clow, Camden.

NEWARK, N. J.—A. Hollander & Sons, 123-29 Kinney street, will erect a four-story brick factory to cost $63,000.

NEWARK, N. J.—The Central Railroad of New Jersey will erect a 1-story storage building to cost $6,000.

NEWARK, N. J.—John Campbell & Co., Plum Point lane, will erect a 2-story drying and storage building, 18 x 86 feet, to cost $7,000.

PASSAIC, N. J.—American Color Mfg. Co. has been incorporated to manufacture and deal in colors, chemicals, etc., with $100,000 capital by Arthur B. Sinclair, Claude G. Francis, Elvin H. Killheffer, Passaic.

SOUTH RIVER, N. J.—Brewster & Robbins Co. has been incorporated to manufacture chemicals with $100,000 capital, by Isidor Grief, Joseph Baris, Weehawken; Solomon Baris, New York City.

TRENTON, N. J. — The Electric Porcelain Mfg. Co. contemplates erecting $70,000 addition to plant on New York avenue.

TRENTON, N. J.—State of New Jersey will build an armory at Plainfield to cost $25,000 and an addition to the armory at Newark to cost $40,000.

TRENTON, N. J.—The Manufacturers' Selling Co. has contracted for a 2-story warehouse, 50 x 100, at Parker and Olden avenues, to cost $10,000.

TRENTON, N. J.—John A. Roebling's Sons Co. is asking for 3,000 tons of steel to be used largely for construction of buildings for the concern in this city.

TRENTON, N. J.—Forced to leave Belgium on account of the Teutonic invasion and the seizure of its plant by soldiers, the Antimony & Compounds Co. of America has been incorporated in New Jersey with a capital of $200,000. The office of the company is in Piscataway and the incorporators are Joseph Dhavetnas, Eric Goodwin, New Brunswick; Robert L. Hoguet, New York.

VINELAND, N. J.—Doerr Glass Co. has been incorporated to manufacture and deal in glass, with $50,000 capital, by Herman R. Doerr, Francis Doerr, Albert J. Doerr, Vineland.

ASPINWALL, PA.—The board of education is receiving bids on a 2-story high school, 75 x 160 feet, to cost about $75,000. P. C. Dowler, Arrott building Pittsburgh, is preparing the plans.

BANGOR, PA. — The Neverbreak Products Co. has been incorporated with $10,000 capital to manufacture brake shoes, by E. H. Steinmetz, S. A. Tell and E. J. Lee.

GREENSBURG, PA.—The Hempfield Foundry & Machine Co. is about to equip the addition it is now building to its plant. Electric cranes and foundry equipment will be purchased.

HUNTINGTON, PA.—Cabell county court is receiving bids on superstructure of Four Pole bridge, to cost about $50,000. Oliver & Maupin, Huntington, are county engineers.

McKEES ROCKS, PA.—The board of education has voted $150,000 school bonds.

McKEES ROCKS, PA.—The plant of the James McKay Co., chain manufacturer, Thompson avenue, was damaged by fire recently. The fire started in the machine shop. The loss is estimated at $10,000.

NEW CASTLE, PA.—The Elliott-Blair Steel Co. is rebuilding its entire original plant, to cost about $40,000.

PITTSBURGH.—The pattern and machine shop of the J. P. J. B. Milhelland Co., Boyd, Watson and Diamond streets, was slightly damaged by fire recently.

PITTSBURGH.—The Investment Land Co. has awarded the Stone & Webster Engineering Co., 120 Broadway, New York, a contract for erecting a 7-story reinforced concrete warehouse, 200 x 300 feet, to cost about $600,000.

PITTSBURGH.—The Westinghouse Electric & Mfg. Co. will begin soon the erection of a plant to cost $6,000,000 on a site recently purchased on the Delaware river at Essington, Pa.

SHARON, PA.—The Sharon Lodge of Elks plans to build a 4-story building, to cost about $50,000. E. J. Weaver, McDowell building, is preparing the plans.

SISTERSVILLE, PA. — The Byan Boiler Works has awarded the Bellefontaine Bridge & Steel Co., Bellefontaine, O., a contract for erecting a plant, to cost about $25,000.

WILLIAMSPORT, PA. — Samuel Larrivee has been awarded a contract by Cheesman & Elliott, 100 William street, New York City, for erecting a 2-story paint factory, 75 x 100 feet.

WILMINGTON, DEL.—The American Sleeve Valve Motor Co. has been incorporated with $3,000,000 capital as mechanical and electrical engineer, by F. R. Hensel, G. H. B. Martin and S. C. Seymour.

IRON ORE

Don't take chances on your 1917 ore.

We are in a most excellent position to interest you in *Service*, *Quality* and *Price*.

Shipments of our Lake Superior Iron Ores are made from ***Open Pit Mines.***

Don't Be Caught Napping

Be one of the *"early birds"*—don't wait for the "last call"—place your order for Iron Ore *right now!*

More than one user of Iron Ore is doomed to a sad disappointment before the coming year has advanced very far.

This is because of the approaching Iron Ore shortage—a shortage that will mean huge losses to many.

If you would not be one of the disappointed ones—*ORDER NOW!*

The Tod-Stambaugh Company

Perry Payne Building

CLEVELAND - - - OHIO

Activities in the Central States

ALLIANCE, O. — The Buckeye Twist Drill Co. is planning to increase its capital to make provisions to double its present plant.

BELLEFONTAINE, O.—The A. J. Miller Co. will erect a 3-story plant to use for assembling automobiles and for offices.

BELLEFONTAINE, O. — The Kauffman Metal Parts Co. has been incorporated with $50,000 capital by J. S. Kauffman, W. H. Eichholtz, C. M. Johnson, E. R. Albaugh and B. D. Hiatt.

CLEVELAND.—W. J. Carter, engineer, is preparing preliminary plans for the first of a group of buildings soon to be erected by the Union Salt Co.

CLEVELAND. — The Doyle Machinery Co. has been incorporated with $10,000 capital by J. A. Doyle, E. B. Earl, J. H. Woods and J. F. McCarthy.

CLEVELAND.—The Universal Patents Mfg. Co. has been incorporated with $50,000 capital by E. Jeffreys, H. H. Lorimore, A. E. Kintner, et al.

CLEVELAND.—The city is preparing plans and specifications for two new gas engines.

Equipment Wanted!

THE Utah Copper Co., C. F. Jennings, assistant purchasing agent, McCornick building, Salt Lake City, Utah, has inquired for the following tools, preferably second hand, and all motor driven:

One Landis pipe and nipple machine to take ⅛-inch to 2½-inch pipe.

One Universal radial drill for 3-inch holes.

One 18-inch lathe.

One 24-inch lathe.

One key seater.

One 60-inch vertical boring mill.

One 12-foot boring mill.

One gear shaper from one to 12-inch face.

One sensitive drill press.

One motor reversing planer, 10-foot table.

An appropriation of $17,000 has been made for this purpose.

CLEVELAND.—The Britton Carburetor Co. has been incorporated with $50,000 capital by L. M. Diehl, A. C. Diehl, P. C. Jones, C. F. Schultz and G. C. Middleton.

CLEVELAND. — The Carbo-Hydrogen Co., Pittsburgh, has acquired a site, 90 x 120 feet, on which it plans to erect a plant for the manufacture of carbo-hydrogen gas to be used for welding purposes.

CLEVELAND.—The Valley Smelting Co has obtained a site on Bradley road, to be used for a smelting and refining plant to handle waste materials and merchandizing non-ferrous metals.

CLEVELAND.—The Union Engineering Co. has purchased the plant of the J. N. Hahn Co., box manufacturer. The company plans to remodel the plant and to equip it for the manufacture of special hoisting and conveying machinery.

CLEVELAND.—Plans have been filed with the building inspector for a 3-story and basement addition to the plant of the Ohio Varnish Co., to be located at 8709 Kinsman road. The general contract for the building, which will be 70 x 75 feet and which will cost $25,000, has been awarded to the Stemple Construction Co.

CLEVELAND.—C. H. Miller, formerly of the Champion Stove Co., announces that a $50,000 plant for a general jobbing foundry business will be erected on a 12-acre site on State road. The proposed structure will be 100 x 260 feet.

DAYTON, O.—The Dayton Wire Wheel Co. has been incorporated with $250,000, by A. M. Wilcox, L. H. Roggs, L. W. James, et al.

VAN WERT, O.—The Finkhausen Bros. Mfg. Co. has been incorporated to manufacture safes with $15,000 capital by F. W. and A. E. Finkhausen and J. E. Rance.

WARREN, O.—The Warren Mirror Works is about to be incorporated with $50,000 capital by C. J. Daniels and G. D. Eberhart, Buffalo. A site 135 x 165 feet, has been acquired and a 1-story, 75 x 150-foot plant will be erected which will be equipped with electrically-driven machinery.

CLARKSBURG, W. VA. — The Hartland Coal Co. plans to erect a $750,000 power plant on Mill creek.

DUNBAR, W. VA.—The Virginian Potteries Co., recently incorporated with a capital of $300,000, plans to build a plant.

PRINCETON, W. VA. — A. S. Hecker, Pittsburgh, and H. E. DeJarnette, Princeton, have applied for a franchise to construct a 5 or 6-mile steam, electric or horsepower railway from Princeton to Athens.

WHEELING, W. VA.—The United States engineers have awarded the Penn Bridge Co., Beaver Falls, Pa., a contract for constructing lock gates at Dam No. 24, Ohio river, to cost $52,440.

WHEELING, W. VA.—J. Velas, T. Kokenes, Wheeling, and S. Gallas, East Liverpool, O., plan to build a theater, 67 x 136 feet, at Market and Sixteenth streets, to cost about $100,000.

INDIANAPOLIS.—The Burkhardt Motor Co. has been incorporated to manufacture engines, with $10,000 capital, by L. Burkhardt, N. H. Wible and Alexander Burkhardt.

INDIANAPOLIS. — The National Motor & Vehicle Corporation, recently incorporated, with $5,000,000 capital stock, has taken over the National Automobile Co. and will build additions.

LAPORTE, IND.—The U. S. Slicing Machine Co. has been incorporated to manufacture meat slicing machines, with $1,200,000 capital, by E. E. Gore, G. V. Irving and J. C. Woodington.

MADISON, IND.—Fire on the night of Dec. 15 damaged the plant of the Tower Tack & Mfg. Co. at a loss estimated at $150,000. The factory was owned and operated by the Tower Mfg. Co., of Cincinnati, Ohio, W. F. Robertson, president.

MOTOR SPEEDWAY CITY, IND. — The Highway Tractor Co., recently incorporated with $2,000,000 capital by Carl Fischer, James Allison, Quincy Myers, et al., will erect a large plant in this city.

NEWCASTLE, IND.—The National Spring Co. has increased its capital from $25,000 to $50,000.

PORTLAND, IND. — The Portland Body Works, manufacturer of automobile bodies will build a 3-story factory costing $15,000.

TERRE HAUTE, IND. — The Standard Wheel Co. is preparing to build a malleable foundry.

WALKERTON, IND. — The C. R. Folson Iron Works has been incorporated with $35,000 capital to manufacture iron tanks, etc., by O. C. Shockney, W. A. Endley and V. W. Hardinbrook.

CHICAGO.—The Wald Adding Machine Co., 232 E. Ohio street, is building a 3-story factory costing $95,000.

CHICAGO.—D. J. Hauptman, 5325 Kenmore avenue, will build a foundry at 1738 Kolmar avenue, costing $15,000.

CHICAGO.—The Pierce Fluor Spar Co. has been incorporated with $50,000 capital by H. A. White, J. C. Sheridan and G. H. Clark.

CHICAGO.—The S. O. S. Spring Hub Co. has been incorporated with $50,000 capital, by Earl M. Hardine, Leo P. Quinn and Lawrence Reibstein, 456 St. James Place.

CHICAGO.—The Chicago Flexible Shaft Co. will build an addition to its plant at Twelfth street and Fifty-sixth avenue, costing $180,000. S. N. Crowen, 30 N. La Salle street, is architect.

CHICAGO.—The Bigelow Electric Mfg. Co. has been incorporated with $5,000 capital by Leo Weisskopf, V. O. Appel and Edward J. Hennesay, 39 S. La Salle street.

CHICAGO.—The board of public works, John Erickson, city engineer, is planning bridge construction for the near future amounting to $6,500,000.

CHICAGO.—The Chicago Steel & Wire Co., 1123 W. Thirty-seventh street has bought a site at 103rd street and Torrence avenue, and will build a plant costing $40,000.

CHICAGO.—Bids will be received about Jan. 1 on the Calumet pumping station, 90 x 133 feet, to cost $2,000,000. D. W. Morrison, 910 S. Michigan avenue, is engineer.

CHICAGO.—Arnold Schwinn & Co., 1718 N. Kildare avenue, bicycle manufacturer, will build a 1-story factory, 95 x 134 feet, costing $15,000.

CHICAGO.—The Standard Spiral Pipe Works is in the market for an electrical or steam-

Do You Know That:

THE Phoenix Iron Works Co., Meadville, Pa., has opened a branch office in Philadelphia, in charge of District Sales Manager J. E. Kindregan. The new office is located at 913 Harrison building.

* * *

The Buffalo Bolt Co. has opened a branch office at 1107 Chemical building, St. Louis. The office is in charge of A. M. Jones.

* * *

The Texas Steel Co., Beaumont, Tex., which recently was organized to operate the ore fields in this district plans to open a branch office in Dallas.

* * *

When E. J. Birtwell resigned as manager of the Baldt plant of the Penn-Seaboard Steel Corporation, New Castle, the heads of the departments presented him with a gold fob. R. C. Munson will succeed him as manager of this plant.

driven hammer large enough for forging ¾-inch material, 32 inches outside diameter.

CICERO, ILL.—The Automatic Screw Machine Products Co. will build a 2-story factory 36 x 300, costing $25,000. Day & Zimmerman, 611 Chestnut street, Philadelphia, are architects.

GIBSON CITY, ILL.—The board of local improvements will take bids about April 1 on an electric light plant and water works costing $30,000. Melluish & Brayhill, Utility building, Bloomington, are engineers.

HOOPESTON, ILL.—The Vermillion Malleable Iron Co. will build an addition to its foundry, 49 x 56 feet, and to its pattern shop 40 x 56 feet.

NORTH CHICAGO. — McClernan & Co., manufacturers of metal products, 122 S. Michigan avenue, Chicago, are building a 1-story plant 151 x 172 feet, to cost $35,000.

PONTIAC, ILL. — Livingston county commissioners will take bids about Feb. 1 on a bridge over the Vermillion river, containing three 90-foot spans with 42-foot roadway of reinforced concrete, costing $30,000.

QUINCY, ILL.—The Gardner Governor Co. is building an addition to its shop to cost $50,000.

QUINCY, ILL.—The Stone Tractor Mfg. Co. has been incorporated with $100,000 capital by G. M. Stone, W. C. Brady and J. L. Fulton.

STERLING, ILL.—The Sterling Foundry is planning to make a 50 x 50-foot addition to its plant. An extension 50 x 270 feet is now in process of construction.

WAUKEGAN. — The Northern Brass Co. plans additions to its plant.

DETROIT.—The Gabriel Reinforcing Co. will build a factory on Bellevue avenue, costing $18,000.

DETROIT.—The Michigan Wire Cloth Co. will build a factory on Wabash street, costing $30,000.

DETROIT. — The National Body & Trimming Co. has been incorporated with $100,000 capital, by A. C. Knapp, T. J. Gillam and J. M. Ackerman.

DETROIT.—The National Machine Products Co. has been incorporated with $150,000 capital by W. H. McGregor, J. G. Gervais and H. L. McGregor.

DETROIT.—Estimates of the cost of the Belle Isle bridge call for $2,000,000 and of a subway approximately $125,000. M. E. Cooley, University of Michigan, is chairman of the board of consulting engineers.

DETROIT.—Buhl Sons & Co. will build a steel warehouse, 4 stories, 30 x 402 feet, a crane building 80 x 402 feet, a storage building 65 x 402 feet, and a dock 480 feet long. John Scott & Co., 2326 Dime Bank building are architects. Arthur H. Buhl, 123 W. Woodbridge avenue, is general manager.

LANSING, MICH.—The Lansing Stamping & Tool Co. has increased its capital stock from $40,000 to $100,000 and will build additions.

LANSING, MICH.—The Duplex Truck Co., recently incorporated with $1,000,000 capital stock, has taken over the plant of the Duplex Power & Car Co. at Charlotte, Mich., and will move to Lansing, where a new plant will be built. H. M. Lee is president and general manager.

BERLIN, WIS. — F. A. Whiting, Buick dealer, is erecting a new garage, service station and repairshop, 50 x 66 feet, of reinforced concrete and brick, on East Ceresco street.

GREEN BAY, WIS.—The Peerless Tire & Rubber Co. of Green Bay, has been organized with $50,000 capital stock by F. E. Burrall, John P. Jessen and A. W. Brown. It is planned to establish a tire plant in Green Bay early next year by absorbing a company now operating in Ohio.

MANITOWOC, WIS.—The Aluminum Goods Mfg. Co. has plans for the erection of a large rolling mill.

MILWAUKEE. — The Wisconsin Iron & Wire Works has been granted a permit to erect a $22,000 factory.

MILWAUKEE. — F. E. Gray, architect, is nearly ready for bids for the erection of a 2-story factory, 50 x 90 feet, for the English Woolen Mills Co., Charles Kasik, manager, 204 Third street.

MILWAUKEE.—Architect A. C. Eschweiler is taking bids for the erection of the new Northeast exchange of the Wisconsin Telephone Co. on Oakland avenue. It will be 50 x 75 feet, two stories and basement.

SOUTH MILWAUKEE, WIS.—The Stowell Co. is erecting a 40 x 80-foot, 2-story addition to its plant to be used as a core-making department. It will be equipped with modern machinery, including sand conveyors, core ovens, etc.

ST. LOUIS.—The plant of the American Foundry & Mfg. Co. recently was damaged by fire to the extent of $10,000.

ST. LOUIS. — The Key Boiler Equipment Co. has been incorporated with $30,000 capital by N. P. Finigan, G. E. Southwick and M. M. Myers.

ST. LOUIS.—The Wurlele-Veregge Machine Co. has been incorporated with $20,000 capital as machinist, by C. and A. E. Wurlele and F. L. Veregge.

CEDAR FALLS, IA.—The Universal Hoist Co. is building a 3-story factory.

FT. DODGE, IA. — Bids will be received about Jan. 1 on bridges for Webster county, to cost $30,000. J. L. Parsons is engineer.

HAMPTON, IA.—Plans are under way for five steel bridges. A. G. Baker is county engineer.

INDEPENDENCE, IA. — Bids will be received until Jan. 9 by W. H. Wilson, mayor, for material and equipment for a complete waterworks system.

STORM LAKE, IA.—Plans are being made by Buena Vista county for a 60-foot and a 130-foot truss span bridge. G. K. McCullough is engineer.

WEBSTER CITY, IA.—Bids will be received until Jan. 8 on improvements to the electric light and water works plant.

South of the Mason-Dixon

LOUISVILLE, KY.—Construction of a terminal warehouse to cost up to $1,500,000 is proposed by the Kentucky & Indiana Terminal Co., operating the Kentucky & Indiana bridge and terminals in Louisville. The Southern, the Monon and the B. & O. railroad companies are interested.

PADUCAH, KY.—The Sherill-Russell Lumber Co. has obtained a contract at $45,000 for construction of a foundry, nickel shop and crate shop for the Wilson Stove Co., which is establishing a plant across the river at Metropolis, Ill.

WINCHESTER, KY.—A contract for construction of a foundry on the site of that recently burned has been let to R. P. Scobee & Son, Winchester. The plant will be occupied by the Love Foundry & Machine Co. which recently organized here and took over the former plant.

BATESVILLE, ARK.—F. C. Hoyt, county judge, Batesville, will receive bids on Jan. 3 on five steel bridges.

EUREKA SPRING, ARK. — Bids will be taken soon on a steel bridge 375 feet long, consisting of two spans, each 187½ feet long or two 100 and one 75-foot spans. R. D. Alexander is engineer.

JONESBORO, ARK.—The Williams Rotary Ditching Machine Co. has been incorporated with $100,000 capital, by J. W. Roy, president, and J. W. Watkins, secretary.

LITTLE ROCK, ARK.—The city of Little Rock plans to build a steel bridge 1,743 feet long, with 36-foot roadway, costing $300,000. Moorhead Wright is chairman of the board of commissioners.

NEWPORT, ARK. — The Iron Mountain railroad is reported to be preparing to spend $1,000,000 on improvements.

The Pacific Coast States

COALTON, CAL.—The Fontana Power Co. is having plans prepared for a hydro-electric plant of 1,800 kilowatt capacity.

HUNTINGTON PARK, CAL. — A contract will be let soon by the Axelson Machinery Co., 1406 N. San Fernando road, Los Angeles, for a pump and lathe manufacturing plant, including a machine shop 126 x 375 feet, pattern shop 35 x 86 feet, storage building 25 x 86 feet, and office 33 x120 feet.

LOS ANGELES.—The Scapa Light & Power Co. is planning to build a hydro-electric plant on the Venture river. R. Bennett, Central building, Los Angeles, is engineer.

LOS ANGELES. — The Baker Iron Works will build an addition 100 x 300 feet, steel frame and corrugated steel covering, equipped with two 25-ton electric traveling cranes, at a cost of $65,000.

NILAND, CAL. — The Southern Sierras Power Co. plans a transmission line to cost $150,000.

OAKLAND, CAL.—The Imperial Engine Co. is building an addition to its plant.

OAKLAND, CAL.—H. W. Leach will build a 1-story machine shop costing $6,000.

SAN BERNADINO, CAL. — The Atchison, Topeka & Santa Fe railroad will contract soon for a steel and brick car shop, 135 x 275 feet, and a planing mill 80 x 200 feet.

SAN FRANCISCO.—L. Gillig will build a 3-story brick machine shop 82 x 120 feet.

VANCOUVER, B. C.—The Vancouver Drydocks Co. has completed arrangements for the construction of a 16,000 ton double-section floating drydock, capable of accommodating an 18,000-ton vessel.

IRON AND STEEL PRICES

Corrected up to Tuesday noon

PIG IRON

Bessemer valley	$35.00
Bessemer, Pittsburgh	35.95
Basic, Pittsburgh	30.95
Basic, eastern Pa.	30.50 to 31.00
Basic, Buffalo	35.00
Malleable, Pittsburgh	31.95 to 33.95
Malleable foundry, Chicago	30.00
Malleable foundry, Philadelphia	32.00 to 33.00
Malleable foundry, Buffalo	35.00
No. 1X foundry, Philadelphia	30.50 to 31.50
No. 2 foundry, Pittsburgh	31.95 to 33.95
No. 2 foundry, Cleveland	30.30 to 31.30
No. 2 foundry, Ironton	30.00
No. 2 foundry, Chicago	30.00
No. 2X foundry, Philadelphia	29.50 to 30.50
No. 2X foundry, N. J. tidewater	29.50 to 30.50
No. 2X foundry, Buffalo	35.00
No. 2 plain, Philadelphia	29.00 to 29.50
No. 2 plain, N. J. tidewater	29.00 to 29.50
No. 2 plain, Buffalo	35.00
No. 2 southern, Birmingham	23.50 to 25.00
No. 2 southern, Cincinnati	25.90 to 27.90
No. 2 southern, Chicago	26.00 to 27.00
No. 2 southern, Phila. delivery	28.00 to 30.00
No. 2 southern, Cleveland	27.50 to 29.00
No. 2 southern, New York docks	28.25 to 30.25
No. 2 southern, Boston docks	28.00 to 30.00
No. 2 south. interior, New Eng.	29.00 to 31.00
No. 2 southern, St. Louis	
Virginia No. 2X furnace	26.00 to 28.00
Virginia, No. 2X, Philadelphia	28.75 to 30.75
Virginia, No. 2X, Jersey City	29.00 to 31.00
Virginia 2X, Boston points	29.25 to 31.25
Gray forge, eastern Pa.	28.50 to 29.00
Gray forge, Pittsburgh	30.95
Gray forge, Birmingham	22.00
Silveries, 8 per cent, furnace	36.00 to 37.00
Silveries, 8 per cent, Chicago	38.50
Low phos. Standard, Phila.	52.00 to 55.00
Low phos. Lebanon, Pa., furnace	50.00 to 55.00
Low phos., Pittsburgh	50.00 to 51.00
Charcoal, Lake Superior, Chgo., Nos. 1 to 4	33.75 to 34.75
Charcoal, Buffalo	24.00 to 27.00
Charcoal, Birmingham	26.00 to 27.00

IRON ORE

Lake Superior Ores.
(Lower Lake Ports.)

Old range Bessemer, 55 per cent, ton	5.95
Mesabi Bessemer, 55 per cent, ton	5.70
Old range non-Bes., 51½ per cent, ton	5.20
Mesabi non-Bess., 51½ per cent, ton	5.05

Port Henry Ores.
(Per unit delivered eastern Pa.)
(All non-Bessemer.)

Old Bed, crude, 58 per cent.	10.50c to 11.00c
Old Bed, concent., 65 per cent	11.00c to 11.50c
Harmony concent., 63 per cent	11.50c to 11.75c
Lump (at mines)	$5.75

Foreign Ores.
(Per unit Philadelphia.)

Foreign Bess., 50 to 65 per cent	nominal
For'n non-Bess., 50 to 65 per cent	nominal

COKE

(At the ovens.)

Connellsville furnace	$10.00
Connellsville fur., contract	5.00
Connellsville foundry, contract	6.00 to 6.75
Connellsville foundry	11.00 to 12.00
Wise county furnace, contract	4.50 to 5.00
Wise county foundry, contract	5.00 to 7.00
Pocahontas foundry, contract	5.00 to 7.00
Pocahontas furnace, contract	4.50 to 5.00
New River foundry, contract	5.25 to 5.75
New River furnace, contract	5.00 to 5.50

FERRO ALLOYS AND STEEL MAKING METALS

Ferro manganese, 80 per cent, seaboard, or delivered prompt	$164 to 175
Ferro manganese, 80 per cent, seaboard, or delivered, contract	164 to 175
Spiegel, 20 per cent, fur. early and last half	50.00 to 60.00
Ferro-silicon, 50 per cent, Pbg.	95.00 to 100.00

Bessemer ferro-silicon, 9 per cent to 10 per cent, $41.00; 10 to 11 per cent, $42.00; 11 to 12 per cent, $43.00; 12 to 13 per cent, $44.00 a ton at the furnace at Ashland, Jackson and New Straitsville, O.

Ferro-carbon titanium, 8 to 12½ cents per pound in carloads.

SEMI-FINISHED MATERIAL

Open hearth billets, Phila.	$55.00 to 60.00
Forging billets, Phila.	75.00 to 85.00
Forging billets, Pbgh., nominal	75.00 to 85.00
Forging billets, Chicago	70.00
Wire rods, Pittsburgh	70.00 to 75.00
Bessemer billets, Youngstown	60.00 to 65.00
Bessemer billets, Pittsburgh	60.00 to 65.00
Open hearth billets, Pittsburgh	60.00 to 65.00
Open hearth billets, Youngstown	60.00 to 65.00
Bess. sheet bars, Youngstown	60.00 to 65.00
Op. h'th sheet bars, Youngstown	60.00 to 65.00
Bess. sheet bars, Pittsburgh	60.00 to 65.00
Open hearth sheet bars, Pbgh.	60.00 to 65.00
Muck bars, Pittsburgh (nominal)	50.00

SKELP

Grooved steel skelp	3.00c to 3.10c
Sheared steel skelp	3.50c to 3.60c

RAILS AND TRACK MATERIAL

(Gross tons.)

Stand. Bess. rails, Pbgh & Chgo.	$38.00
Stan. op-h'th rails, Pbg. & Chgo.	40.00
Light rails 8 to 10 lbs., Pbgh.	53.00
Light rails, 8 lb., Chicago	49.00
Light rails, 12 to 14 lbs., Pbgh.	52.00
Light rails, 12 lbs., Chicago	47.00
Light rails, 16 to 20 lbs., Pbgh.	51.00

Freight Rates, Pig Iron

Mahoning and Shenango valleys to:—	
Cleveland	$0.95
Newark, N. J.	2.98
Boston	3.18
Philadelphia	2.78
Pittsburgh	.95
St. Louis	3.18
Buffalo to:—	
Albany, N. Y.	$1.26
New England (all rail)	2.58
New York and Brooklyn (all rail)	2.58
New York and Brooklyn (by canal)	1.25 to 1.60
Virginia furnaces to:—	
Boston docks (r. and w.)	$3.05
New England (all rail)	3.25
New York dock (r. and w.)	2.88
Birmingham, Ala., to:—	
Cincinnati	$2.90
Chicago	4.00
Cleveland	4.00
Louisville, Ky.	2.65
New York (all rail)	6.15
New York (r. and w.)	4.25
Philadelphia (all rail)	5.20
Philadelphia (r. and w.)	4.00
Pittsburgh	4.90
Savannah, Ga.	2.75
Chicago to:—	
Des Moines	$2.80
Milwaukee	.50
Moline, Ill.	1.40
Omaha	3.58
St. Louis	1.58
Ironton and Jackson, O., to:—	
Chicago	$2.54
Cincinnati	1.26
Cleveland	1.62
Detroit	1.81
Indianapolis	1.58

Light rails, 16 to 20 lbs., Chgo.	$46.00
Light rails, 25 to 45 lbs., Pbgh.	50.00
Light rails, 25 to 45 lbs., Chgo.	45.00
Relaying rails, standard, Pbgh. and Chicago	35.00
Relaying rails light, Chicago	34.00 to 35.00
Angle bars, st. sect., Pbgh. base	2.50c to 2.75c
Angle bars, st. sections, Chgo.	2.25c to 2.75c
Spikes, railroad, Pittsburgh	3.40c
Spikes, railroad, Chicago	3.50c
Track bolts, Pittsburgh	4.50c to 4.75c
Track bolts, Chicago	4.25c to 4.50c
Tie plates, Chicago	$55.00 to 60.00

SHAPES, PLATES AND BARS

Structural shapes, con. Pbgh.	3.10c
Structural shapes, Pbgh.	3.25c
Structural shapes, Philadelphia	3.259c to 3.659c
Structural shapes, Chicago	3.29c to 3.75c
Structural shapes, New York	3.269c to 3.669c
Tank plates, Chicago	3.89c to 4.25c
Tank plates, Pittsburgh (con.)	3.60c to 4.50c
Tank plates, Pittsburgh	4.50c to 5.00c
Tank plates, Philadelphia	3.909c to 4.659c
Tank plates, New York	3.919c to 4.669c
Bars, soft steel, Chicago	3.19c to 3.50c
Bars, soft steel, Pbgh. (con.)	3.00c
Bars, soft steel, Pittsburgh	3.00c to 3.25c
Bars, soft steel, New York	3.169c to 3.419c
Bars, soft steel Philadelphia	3.159c to 3.409c
Hoops, carloads, Pbgh. contr.	3.25c
Hoops, Pbgh.	4.00c to 4.25c
Bands, Pittsburgh	3.90c to 4.10c
Bands, Pittsburgh (contr.)	2.90c
Shafting, Pbgh., contr. carloads	10 to 20 off
Bar iron, Chicago	3.00c
Bar iron, Philadelphia	3.159c
Bar iron, Cleveland	3.00c
Bar iron, New York	3.169c
Bar iron, Pittsburgh	3.25c
Hard steel bars, Chicago	3.00c

SHEETS

(In cents per pound.)
(Open hearth material takes 10c above prices of bessemer.)

SHEET MILL BLACK.

Gage.	Bessemer.
17 to 21	4.30 to 5.30
22 to 24	4.35 to 5.25
25 and 26	4.40 to 5.40
27	4.45 to 5.45
28	4.50 to 5.50
29	4.55 to 5.55
30	4.65 to 5.65

TIN MILL BLACK.

Gage.	Bessemer.
15 and 16	4.30 to 5.65
17 to 21	4.35 to 5.10
22 to 24	4.40 to 5.15
25 to 27	4.45 to 5.20
28	4.50 to 5.25
29 and 30	4.60 to 5.35
30½ and 31	4.65 to 5.40

GALVANIZED.

Gage.	Bessemer.
10 and 11	5.50 to 6.50
12 to 14	5.60 to 6.60
15 and 16	5.75 to 6.75
17 to 21	5.90 to 6.90
22 to 24	
25 and 26	6.05 to 7.05
27	6.35 to 7.35
28	6.50 to 7.50
29	6.70 to 7.70
30	6.90 to 7.91

BLUE ANNEALED.

Gage.	Bessemer.
3 to 8	4.40 to 4.90
9 to 10	4.25 to 4.75
11 to 12	4.25 to 4.75
13 and 14	4.35 to 4.85
15 and 16	4.40 to 4.80

No. 28 black, Chicago	4.69c
No. 28 galvanized, Chicago	5.19c
No. 10 blue annealed, Phila.	4.159c to 4.659c
No. 10 blue annealed, Chgo.	4.69c

TIN PLATE

Tin plate, 100 lb., coke base	6.50c to 7.50c
Terne plate	5.75c

IRON AND STEEL PIPE

(Prices adopted Dec. 4, 1916.)

Steel.

Butt weld:—	Black.	Galv.
⅛, ¼ and ⅜ in.	59	32½
½ in.	63	48½
¾ to 3 in.	66	52½
Lap weld:—		
2 in.	59	46½
2½ to 6 in.	62	49½
7 to 12 in.	59	45½
13 and 14 in.	49½	....
15 in.	47	....

Iron.

Butt weld:—	Black.	Galv
⅛ and ¼ in.	44	16
⅜ in.	45	17
½ in.	49	30
¾ to 1½ in.	52	35
Lap weld:—		
1⅝ in.	38	22
1½ in.	44	29
2 in.	45	30
2½ to 6 in.	47	33
7 to 12 in.	46	32

BOILER TUBES

Steel, 3½ to 4½ inches l. c. l.	46
Iron 3½ to 4½ inches l. c. l.	36

IRON AND STEEL PRICES

Corrected up to Tuesday noon

WIRE PRODUCTS

(Adopted Nov. 24, 1916.)
(Retailers' price 5 cents above jobbers' quotations.)

Wire nails, jobbers', Pittsburgh	$3.00
Plain wire, jobbers', Pittsburgh	2.95
Galvanized wire, jobbers', Pbgh.	3.65
Polished staples, Pbgh	3.15
Galvanized staples, Pbgh	3.85
Barb wire, painted, jobbers', Pbgh.	3.15
Barb wire, galv., jobbers', Pbgh.	3.85

BOLTS AND NUTS

(Delivered within 20-cent freight radius.)

Carriage bolts, ⅜ x 6 inches, smaller or shorter, rolled thread, 50; cut threads, 40, 7 and ½, larger or longer, 35.

Machine bolts with hot pressed nuts ¾ x 4 inches, smaller or shorter rolled 50, and 5; cut, 40, 10 and 5; larger or longer, 40.

Cold pressed, semi-finished hexagon nuts, 60.

Gimlet and cone point lag bolts, 50. Hot pressed square nuts, blanks, $2.60 off; tapped $2.40 off. Hot pressed hexagon nuts, blank, $2.60 off; tapped, $2.40 off.

Cold pressed square nuts, blank, $2.20 off; tapped, $2.00 off. Cold pressed hexagon nut, blank, $2.50 off; tapped, $2.25 off.

RIVETS

Structural rivets, Pbgh	4.25c
Boiler rivets, Pbgh	4.35c

Tinner's rivets, 45, and 10 off, Pittsburgh.

STEEL SHEET PILING

(Pittsburgh.)

Base sizes	3.10c

STANDARD STEEL CHAIN

Chain, ⅜ inch proof coil	6.00c

COLD ROLLED STRIP STEEL

Base price 7.00c per 100 pounds, hard, coils 1½ inches and wider and by .100 inch and heavier.

CAST IRON WATER PIPE

Four-inch, Chicago	$44.00 to 45.00
Six-inch and larger, Chicago	41.00 to 42.00
Six-inch Class B, New York	41.50
Four-inch Class B, New York	44.50
Four to six-inch Birmingham	39.00
Six-inch and larger, Birmingham	36.00

Light weight water and gas pipe $1 per ton higher than standard water.

WAREHOUSE PRICES

Steel bars, Chicago	3.60c
Steel squares, 2-in. & ov., Cleve.	4.35c
Steel rounds, 2-in. & ov., Cleve.	4.35c
Steel bars, und. 2 in., Cleveland	3.85c
Steel bars, Detroit	3.60c
Steel bars, Philadelphia	3.75c
Steel bars, New York	3.75c
Steel bars, St. Louis	3.65c
Steel bars, Cincinnati	3.70c to 4.25c
Steel bars, St. Paul	3.70c
Steel bars, over 2-in., Buffalo	4.40c
Steel bars, Buffalo	3.75c
Iron bars, Chicago	3.60c
Iron bars, Cleveland	3.80c
Iron bars, Detroit	3.60c
Iron bars, St. Louis	3.60c
Iron bars, Cincinnati	3.70c to 4.25c
Iron bars, Philadelphia	3.50c
Iron bars, New York	3.50c to 3.75c
Shapes, Chicago	3.70c
Shapes, Detroit	3.70c
Shapes, St. Louis	3.75c
Shapes, St. Paul	3.80c
Shapes, New York	3.75c
Shapes, Cleveland	3.95c
Shapes, Philadelphia	3.75c
Shapes, Buffalo	3.85c
Shapes and plates, Cincinnati	3.80c to 4.35c
Plates, Chicago	4.35c
Plates, Detroit	4.35c
Plates, St. Louis	4.40c
Plates, St. Paul	4.45c
Plates, New York, wide	5.00c
Plates, New York, narrow	4.75c
Plates, Cleveland	4.60c
Plates, Philadelphia	4.50c to 5.00c
No. 10 blue anl. sheets, Chicago	4.50c
No. 10 blue anl. sheets, Cleve.	4.25c to 4.50c
No. 10 blue anl. sheets, Buffalo	3.25c
No. 10 blue anl. sheets, St. L.	4.55c
No. 10 blue anl. sheets, Cinci.	4.40c
No. 10 blue anl. sheets, St. Paul	4.60c
No. 10 blue anl. sheets, Detroit	4.25c
No. 28 black sheets, Chicago	5.00c
No. 28 black sheets, Cleveland	4.75c
No. 28 black sheets, Cincinnati	4.40c
No. 28 black sheets, Detroit	4.75c
No. 28 black sheets, St. Louis	5.00c
No. 28 black sheets, St. Paul	5.10c
No. 28 galv. sheets, Chicago	7.00c
No. 28 galv. sheets, Cleveland	6.50c
No. 28 galv. sheets, Cincinnati	6.00c
No. 28 galv. sheets, Detroit	7.00c
No. 28 galv. sheets St. Louis	6.85c
Hoops, Cleveland	4.75c
Hoops, Detroit	4.25c

Coke Oven By-Products

Spot.

Per Gallon at Producers Plant.	
Pure benzol	$0.55
Toluol	1.75 to 2.00
Solvent naphtha	.25
Per Pound at Producers Plant.	
Phenol	$0.50 to .55
Per 100 Pounds at Seaboard.	
Sulphate of ammonia	$4.05 to 4.07½

Contract.

Per Gallon at Producers Plant.	
Pure benzol	$0.55
Toluol	1.60 to 1.75
Solvent naphtha	.25
Per Pound at Producers Plant.	
Phenol (nominal)	$0.55 to .60
Per 100 Pounds at Seaboard.	
Sulphate of ammonia, nearby	$4.05 to 4.07½

IRON AND STEEL SCRAP

(Net Tons.)

Angle bars, iron, Chicago	$28.50 to 29.00
Angle bars, steel, St. Louis	21.00 to 21.50
Arch bars and transoms, St. L.	29.50 to 30.00
Arch bars and transoms, Chgo.	29.00 to 30.00
Cast, No. 1, St. Louis	19.50 to 18.00
Boiler plate, cut, No. 1, Chgo.	15.00 to 15.50
Boiler plate, cut, No. 1, St. L.	14.00 to 14.50
Boiler punchings, Chicago	21.00 to 22.00
Bundled sheet, Cincinnati	13.00 to 13.50
Busheling, No. 1, Chicago	18.25 to 18.75
Busheling, No. 1, Cincinnati	17.00 to 17.50
Busheling, No. 1, Cleveland	18.75 to 19.00
Busheling, No. 1, St. Louis	19.50 to 20.00
Busheling, No. 2, Chicago	13.75 to 14.25
Cast borings, Chicago	10.00 to 10.50
Cast borings, Cincinnati	9.00 to 9.50
Cast borings, Cleveland	10.00 to 10.25
Cast borings, St. Louis	10.00 to 10.50
Cast, No. 1, Chicago	16.50 to 17.00
Cast, No. 1, Cincinnati	16.00 to 16.50
Cast, No. 1, Cleveland	18.75 to 19.25
Cast, No. 1, St. Louis	17.50 to 18.00

Freight Rates, Finished Material

From Pittsburgh, carloads, per 100 lbs. to:—

New York	16.9 cents
Philadelphia	15.9 cents
Boston	18.9 cents
Buffalo	11.6 cents
Baltimore	15.4 cents
Cleveland	10.5 cents
Cincinnati	15.8 cents
Chicago	18.9 cents
Detroit	15.7 cents
Minneapolis and St. Paul	32.9 cents
Denver	83.6 cents
St. Louis	23.6 cents
New Orleans	30 cents
Birmingham	45 cents
Pacific coast (all rail)	73.9 cents
Pacific coast (tin plate)	70 cents
Pacific coast, via Panama canal	61.9 cents

Cut forge, Chicago	24.00 to 25.00
Grate bars, Cleveland	12.00 to 12.50
Iron axles, St. Louis	33.50 to 34.00
Iron axles, Cleve	45.00 to 46.00
Knuckles, coup., Chicago	27.00 to 27.75
Knuckles, coup., St. Louis	26.00 to 26.50
Locomotive tires, Chicago	26.00 to 27.00
Locomotive tires, St. Louis	29.00 to 30.00
Machine shop turnings, Chicago.	10.25 to 10.75
Machine shop turnings, Cleve.	9.75 to 10.00
Machine shop turn'gs, Cincinnati	8.50 to 9.00
Machine shop turnings, St. L.	10.50 to 11.00
Malleable agricultural, Chgo.	16.00 to 16.50
Malleable agricultural, St. Louis	17.00 to 17.50
Malleable, Cincinnati	13.50 to 14.00
Malleable railroad, Chicago	19.50 to 20.00
Malleable railroad, St. Louis	18.00 to 18.50
Pipes and flues, Cleveland	16.00 to 16.50
Pipes and flues, Chgo.	16.00 to 16.50
Pipes and flues, St. Louis	16.50 to 17.00
Railroad wrought, No. 1, Cleve.	30.00 to 31.00
Railroad wrought, No. 1, Chgo.	25.00 to 26.00
Railroad wrought, No. 1, Cinci.	21.00 to 22.00
Railroad wrought, No. 1, St. L.	25.00 to 25.50
Railroad wrought, No. 2, Chgo.	24.00 to 25.00
Railroad wrought, No. 2, St. L.	24.50 to 25.00
Shafting, St. Louis	28.00 to 29.00
Springs, Chicago	27.75 to 28.25
Steel car axles, St. Louis	38.00 to 39.00
Steel car axles, Chicago	42.00 to 43.00
Stove plate, Chicago	12.50 to 13.00
Stove plate, Cleveland	12.75 to 13.00
Stove plate, Cincinnati	12.00 to 12.50
Stove plates, St. Louis	15.50 to 16.00

(Gross tons.)

Axle turnings, Cleveland	$16.75 to 17.25
Axle turnings, Buffalo	17.50 to 18.00
Busheling, No. 1, Buffalo	21.50 to 22.00
Busheling, No. 1, Pittsburgh	18.50 to 19.00
Busheling, No. 2, Buffalo	15.00 to 15.50
Bundled sheets, Pittsburgh	16.00 to 16.50
Bundled sheets, Cleveland	14.50 to 15.00
Bundled sheets, Buffalo	15.00 to 16.00
Bundled tin, Buffalo	15.00 to 16.00
Car wheels, (iron), Pittsburgh	22.00 to 23.00
Car wheels, (steel), Pittsburgh	28.00 to 29.00
Car wheels, Chicago	22.00 to 22.50
Car wheels, eastern Pa	22.50 to 23.50
Car wheels, Buffalo	23.00 to 24.00
Car wheels, New York	21.00 to 21.50
Car wheels, St. Louis	24.00 to 25.00
Car wheels, Birmingham	19.00 to 20.00
Car wheels, Cleveland	21.50 to 23.00
Tram car wheels, Birmingham	17.00 to 18.00
Cast borings, New York	11.50 to 12.00
Cast borings, eastern Pa	14.00 to 15.00
Cast borings, Buffalo	11.50 to 12.00
Cast borings, Pittsburgh	13.25 to 13.50
Cast, No. 1, eastern Pa	21.50 to 22.50
Cast, No. 1, Pittsburgh	20.50 to 22.00
Cast, No. 1, Birmingham	19.00 to 20.00
Cast, heavy No. 1, N. J. points	20.50 to 21.00
Forge, No. 1, eastern Pa	16.50 to 17.50
Frogs, switches, guards, St. L.	23.50 to 24.00
Grate bars, Buffalo	15.50 to 16.00
Grate bars, N. J. points	15.00 to 15.50
Heavy axle turnings, Buffalo	15.00 to 15.50
Heavy melting steel, Pittsburgh	24.00
Heavy melting steel, Buffalo	26.00 to 27.00
Heavy melting steel, Chicago	23.50 to 24.00
Heavy melting steel, Cleveland	23.00 to 24.00
Heavy melting steel, Cincinnati	21.00 to 22.00
Heavy melting steel, eastern Pa	24.00 to 25.00
Heavy melting steel, New York	22.50 to 22.75
Heavy melting steel, St. L	24.50 to 25.00
Heavy melting steel, Birmingh'm	21.00 to 22.00
Hydraulic pressed sheet, Cleve.	17.50 to 18.00
Hydraulic pressed sheets, Pbgh.	22.00 to 23.00
Hydraulic pressed sheets, Chgo.	18.25 to 19.25
Iron rails, Chicago	30.00 to 30.50
Iron rails, Buffalo	25.00 to 26.00
Iron rails, Cincinnati	25.00 to 26.00
Iron rails, St. Louis	26.00 to 27.00
Iron rails, Cleveland	30.00 to 31.00
Iron axles, Pittsburgh	39.00 to 40.00
Iron axles, Cincinnati	41.00 to 42.00
Iron axles, eastern Pa	38.00 to 40.00
Iron axles, Chicago	42.00 to 42.50
Iron axles, Buffalo	45.00
Low phos. steel, Buffalo	32.00 to 34.00
Low phos. steel, Pittsburgh	32.00 to 34.00
Low phos. steel, eastern Pa	32.00 to 34.00
Machine shop turnings, Buffalo	11.50 to 12.00
Mch. shop turnings, New York	11.25 to 11.50
Mch. shop turnings, Pittsburgh	13.00 to 13.50
Mch. shop turnings, eastern Pa	13.00 to 14.00
Mch. shop turnings, Birmingham	10.00 to 11.00
Malleable railroad, Cleveland	21.00 to 22.00
Malleable railroad, Buffalo	23.00 to 24.00
Malleable railroad, Pittsburgh	21.00 to 21.50
Malleable railroad, eastern Pa	18.00 to 19.00
R. R. and mch. cast, No. 1 Bfl.	23.00 to 24.00
R. R. wrought, No. 1, Buffalo	30.00 to 31.00
R. R. wrgt., No. 1, eastern Pa.	27.00 to 28.00
City wrought, New York	21.50 to 22.00
R. R. wrought, No. 1, Pbgh.	23.00
R. R. wrought, No. 1, B'ham	21.00 to 22.00
Reroll. rails, 5 ft. and ov., Pbg.	30.00 to 31.00
Reroll. rails, 5 ft. & ov., Chgo.	28.50 to 29.00
Reroll. rails, 5 ft. & ov., E. Pa.	27.00 to 28.00
Reroll. rails, 5 ft. & ov., St. L.	29.00 to 29.50
Shafting, New York	25.50 to 26.50
Shafting, eastern Pa	31.00 to 32.00
Shoveling steel, Chgo	21.50 to 22.00
Shoveling steel, St. Louis	20.50 to 21.00
Steel rails, short, Chgo	26.00 to 26.50
Steel rails, short, Cleveland	28.00 to 29.00
Steel rails, over 6 ft. Cleveland	24.00 to 24.50
Steel rails, old, Birmingham	21.00 to 22.00
Steel rails, short, St. Louis	27.00 to 28.00
Steel car axles, Birmingham	36.00 to 37.00
Steel car axles, New York	38.00 to 40.00
Steel car axles, Buffalo	45.00
Steel car axles, Cleveland	50.00 to 51.00
Steel car axles, Pittsburgh	39.00 to 40.00
Steel car axles, eastern Pa	38.00 to 40.00
Stove plate, N. J. points	15.00 to 15.50
Stove plate, Birmingham	12.50 to 13.50
Stove plate, Buffalo	16.00 to 16.50
Stove plate, eastern Pa	17.00 to 18.00
Stove plate, Pittsburgh	14.00 to 14.50
Wrought pipe, Buffalo	17.00 to 17.50
Wrought pipe, eastern Pa	19.00 to 20.00
Wrought pipe, New York	17.50 to 18.00

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A classified-by-products list of advertisers for the convenience of readers. If you don't find what you want, write us and we will tell you where to get it. ¶ Index to advertisements will give you page number of any advertiser and by referring to advertisement you can get full particulars about products.

ACCUMULATORS.
Birdsboro Steel Fdy. & Mch. Co., Birdsboro, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Mesta Machine Co., Pittsburgh, Pa.
Tod, Wm., Youngstown, O.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
Wood, R. D., & Co., Philadelphia, Pa.

ACCUMULATORS.
(Hydraulic.)
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Southwark Fdy. & Mch. Co., Philadelphia, Pa.

ACETYLENE IN CYLINDERS.
Linde Air Products Co., New York City.
Oxweld Acetylene Co., Chicago, Ill.
Prest-O-Lite Co., The, Indianapolis, Ind.

AEROPLANE WIRE, STRAND AND CORD.
American Steel & Wire Co., Chicago, Ill.
Roebling's, John A., Sons Co., Trenton, N. J.

ALLOYS.
American Vanadium Co., Pittsburgh, Pa.
Bethlehem Steel Co., The, So. Bethlehem, Pa.
Blackwell, Geo. G., Sons & Co., Ltd., Liverpool, Eng.
Bourne-Fuller Co., The, Cleveland, O.
Carnegie Steel Co., Pittsburgh, Pa.
Central Steel Co., The, Massillon, O.
Titanium Alloy Mfg. Co., Niagara Falls, N. Y.
United Alloys Steel Corp., The, Canton, O.

ALLOYS.
(Steel.)
Ohio Seamless Tube Co., The, Shelby, O.

ALUMINUM.
(Granulated.)
United Smelt'g & Alum. Co., New Haven, Ct.

ALUMINUM.
(Solder.)
United Smelt'g & Alum. Co., New Haven, Ct.

ALUMINUM.
(Vanadium.)
American Vanadium Co., Pittsburgh, Pa.

ALUMINUM ALLOYS.
United Smelt'g & Alum. Co., New Haven, Ct.

ALUMINUM INGOTS.
United Smelt'g & Alum. Co., New Haven, Ct.

ALUMINUM RODS.
(Sheet.)
United Smelt'g & Alum. Co., New Haven, Ct.

ANGLES, TEES, CHANNELS.
(See Steel, Structural.)

ANNEALING BOXES AND POTS.
Blackwood Steel Fdy. Co., The, Springfield, O.
Knox Pressed & Welded Steel Co., Pittsburgh.
Mesta Machine Co., Pittsburgh, Pa.
Pittsburgh Annealing Box Co., Pittsburgh, Pa.
Pittsburgh Malleable Iron Co., Pittsburgh, Pa.
Pittsburgh Valve Foundry & Const. Co., Pittsburgh, Pa.
Swedish Crucible Steel Co., Detroit, Mich.
United Engrg. & Foundry Co., Pittsburgh, Pa.
Zanesville Malleable Iron Co., Zanesville, O.

ANTIMONY.
Wah-Chang Mining & Smelting Co., New York City.

ANTIMONY OXIDES.
Wah-Chang Mining & Smelting Co., New York City.

ARCHITECTURAL SHAPES.
Empire Art Metal Co., College Pt., N. Y.

ARMATURES.
Crocker-Wheeler Co., Ampere, N. J.
General Electric Co., Schenectady, N. Y.
Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

ASH BUCKETS.
Lakewood Engrg. Co., Cleveland, O.

AUTO TOWING CABLES.
American Steel & Wire Co., Chicago, Ill.

AXLES.
American Bridge Co., New York City.
American Steel Export Co., New York City.
Bethlehem Steel Co., So. Bethlehem, Pa.
Cambria Steel Co., Philadelphia, Pa.
Camden Forge Co., Camden, N. J.
Carnegie Steel Co., Pittsburgh, Pa.
Illinois Steel Co., Chicago, Ill.
Lockhart Iron & Steel Co., Pittsburgh, Pa.
National Tube Co., Pittsburgh, Pa.
Otis Steel Co., Cleveland, O.

BABBITT METAL.
Keystone Bronze Co., Pittsburgh, Pa.
Lubricating Metal Co., The, New York City.
Ryerson, Jos. T., & Son, Chicago, Ill.

BAKERS, WIRE COATING.
Morgan Construction Co., Worcester, Mass.
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

BALE TIES.
American Steel & Wire Co., Chicago, Ill.

BALLS.
(Steel.)
Bethlehem Steel Co., The, So. Bethlehem, Pa.
New Departure Mfg. Co., Bristol, Conn.

BANDS.
(Steel.)
Akron-Selle Co., The, Akron, O.
Carnegie Steel Co., Pittsburgh, Pa.

BARGES.
(Steel.)
American Bridge Co., New York City.

BARRELS, TUMBLING.
(Wire Nails.)
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

BARS—ALLOY.
Central Steel Co., The, Massillon, O.

BARS.
(Concrete Reinforcing.)
Bourne-Fuller Co., Cleveland, O.
Carnegie Steel Co., Pittsburgh, Pa.
Cincinnati Iron & Steel Co., Cincinnati, O.
Franklin Steel Works, Franklin, Pa.
Inland Steel Co., Chicago, Ill.
Laclede Steel Co., St. Louis, Mo.
Ryerson, Jos. T., & Son, Chicago, Ill.
Trussed Concrete Steel Co., Detroit, Mich.
Upson Nut Co., Cleveland, O.

BARS.
(Iron and Steel.)
American Bridge Co., New York, N. Y.
American Iron & Steel Mfg. Co., Lebanon, Pa.
American Steel Export Co., New York City.
Belmont Iron Works, Philadelphia, Pa.
Bethlehem Steel Co., The, So. Bethlehem, Pa.
Bourne-Fuller Co., Cleveland, O.
Brown-Wales Co., Boston, Mass.
Cambria Steel Co., Philadelphia, Pa.
Camden Forge Company, Camden, N. J.
Carnegie Steel Co., Pittsburgh, Pa.
Cincinnati Iron & Steel Co., Cincinnati, O.
Franklin Steel Works, Franklin, Pa.
Harvey, Arthur C., Co., Boston, Mass.
Illinois Steel Co., Chicago, Ill.
Illinois Steel Co., Warehouse Dept., Chicago.
Illinois Steel Warehouse Co., St. Louis, Mo.
Illinois Steel Warehouse Co., St. Paul, Minn.
Inland Steel Co., Chicago, Ill.
Jones & Laughlin Steel Co., Pittsburgh, Pa.
Lackawanna Steel Co., Buffalo, N. Y.
Lockhart Iron & Steel Co., Pittsburgh, Pa.
Milton Mfg. Co., Milton, Pa.
Republic Iron & Steel Co., Youngstown, O.
Ryerson, Joseph T., & Son, Chicago, Ill.
Scully Steel & Iron Co., Chicago, Ill.
Standard Gauge Steel Co., Beaver Falls, Pa.
Tennessee Coal, Iron & R. R. Co., Birmingham, Ala.
Trussed Concrete Steel Co., Detroit, Mich.
United Alloys Steel Corp., The, Canton, O.
Upson Nut Co., Cleveland, O.
Westerman & Co., Lockport, N. Y.

BEAMS, CHANNELS AND ANGLES.
American Steel Export Co., New York City.
Belmont Iron Works, Philadelphia, Pa.
Bourne-Fuller Co., Cleveland, O.
Carnegie Steel Co., Pittsburgh, Pa.
Empire Art Metal Co., College Pt., N. Y.
Franklin Steel Works, Franklin, Pa.
Illinois Steel Co., Chicago, Ill.
Ryerson, Joseph T., & Son, Chicago, Ill.
Scully Steel & Iron Co., Chicago, Ill.

BEARINGS.
(Ball.)
New Departure Mfg. Co., Bristol, Conn.

BEARINGS.
(Vanadium Steel.)
American Vanadium Co., The, Pittsburgh, Pa.

BELT CEMENT AND DRESSING.
Graton & Knight Mfg. Co., Worcester, Mass.
Texas Company, The, New York City.
Williams, I. B., & Sons, Dover, N. H.

BELT LACING.
(Leather.)
Chicago Rawhide Mfg. Co., Chicago, Ill.
Graton & Knight Mfg. Co., Worcester, Mass.
Williams, I. B., & Sons, Dover, N. H.

BELTING.
(Chain.)
Link-Belt Company, Chicago, Ill.

BELTING—LEATHER.
Chicago Rawhide Mfg. Co., Chicago, Ill.
Graton & Knight Mfg Co., Worcester, Mass.
Williams, I. B., & Sons, Dover, N. H.

BENCHES.
(Steel.)
New Britain Mach. Co., New Britain, Conn.

BENCHES AND FRAMES.
(Drawing.)
Morgan Construction Co., Worcester, Mass.
Turner, Vaughn & Taylor Co., The, Cuyahoga Falls, O.

BENDING AND STRAIGHTENING MACHINES.
Abramsen Engrg. Co., Pittsburgh, Pa.
Bertsch & Co., Cambridge City, Ind.
Birdsboro St'l Fdy. & Mch. Co., Birdsboro, Pa.
Cleveland Punch & Shear Works Co., Cleveland, O.
Espen-Lucas Machine Works, Philadelphia, Pa.
Hinman, D. A., & Co., Sandwich, Ill.
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Niles-Bement-Pond Co., New York, N. Y.
United Engrg. & Fdy. Co., Pittsburgh, Pa.

BENZOL, RECOVERY PLANTS.
Koppers, H., Co., Pittsburgh, Pa.

BESSEMER SQUARES.
(Soft.)
Witherow Steel Co., Pittsburgh, Pa.

BILLETS.
American Steel Export Co., New York City.
Bethlehem Steel Co., The, So. Bethlehem, Pa.
Bourne-Fuller Co., Cleveland, O.
Cambria Steel Co., Philadelphia, Pa.
Carnegie Steel Co., Pittsburgh, Pa.
Central Steel Co., The, Massillon, O.
Illinois Steel Co., Chicago, Ill.
Inland Steel Co., Chicago, Ill.
La Belle Iron Works, Steubenville, O.
Lackawanna Steel Co., Buffalo, N. Y.
Otis Steel Co., Cleveland, O.
Republic Iron & Steel Co., Youngstown, O.
Tennessee Coal, Iron & R. R. Co., Birmingham, Ala.
Upson Nut Co., Cleveland, O.
Whitaker-Glessner Co., Portsmouth Works, Portsmouth, O.
Wickwire Steel Co., Buffalo, N. Y.
Wood, Alan, Iron & Steel Co., Philadelphia.
Youngstown Sheet & Tube Co., Youngstown.

BINS.
(Steel.)
Empire Art Metal Co., College Pt., N. Y.

BLAST FURNACE SKIP CARS.
Lakewood Engrg. Co., Cleveland, O.

BLAST FURNACE TUYERES.
Keystone Bronze Co., Pittsburgh, Pa.

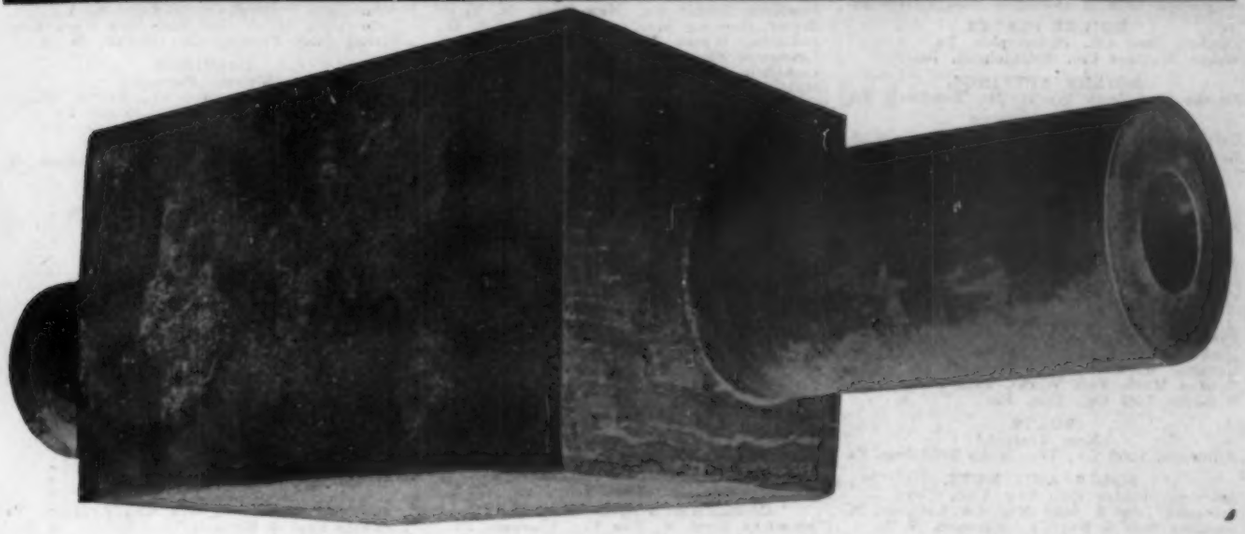
BLAST FURNACE VOLUME METERS.
Clark, Chas. J., Chicago, Ill.

BLOCKS.
(Chain.)
Yale & Towne Mfg. Co., New York City.

BLOOMS.
American Steel Export Co., New York City.
Bethlehem Steel Co., The, So. Bethlehem, Pa.
Bourne-Fuller Co., Cleveland, O.
Carnegie Steel Co., Pittsburgh, Pa.
Hillman, J. H., & Sons, Pittsburgh, Pa.
Illinois Steel Co., Chicago, Ill.
La Belle Iron Works, Steubenville, O.
Lackawanna Steel Co., Buffalo, N. Y.
Tennessee Coal, Iron & R. R. Co., Birmingham, Ala.
Upson Nut Co., Cleveland, O.
Wood, Alan, Iron & Steel Co., Philadelphia.
Youngstown Sh't & Tube Co., Youngstown, O.

See Index to Advertisements for Pages Containing Advertisements of Companies Listed Above

CAMDEN



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Power Press Crank Shafts
Cam Shafts

Eccentric Shafts
Crusher Shafts
Gear and Pinion Blanks
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Hammered Iron Bars for locomotive repairs

Marine Shaft
Marine Connecting and Eccentric Rods
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Large Wrenches
Saw Arbors
Steam Engine Forgings
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Mill Shafting
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Electric Motor Axles

Any forging to your print and specifications, smooth forged, rough machined or finished complete in either iron or steel.

CAMDEN FORGE CO.
Bulson Ave., CAMDEN, N.J.

BLOWERS.
Connersville Blower Co., The, Connersville, Ind.
General Electric Co., Schenectady, N. Y.
Gilbert & Barker Mfg. Co., Springfield, Mass.
Roots, P. H., & F. M., Co., Connersville, Ind.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

BLUE PRINTING MACHINES.
(Electric.)
Wickes Brothers, Saginaw, Mich.

BOILER INSULATION.
Armstrong Cork & Insulation Co., Pittsburgh.

BOILER PLATES.
Cambria Steel Co., Philadelphia, Pa.
Worth Brothers Co., Philadelphia, Pa.

BOILER SETTINGS.
Eureka Fire Brick Works, Mt. Braddock, Pa.

BOILER TUBES.
Detroit Seamless Steel Tubes Co., Detroit, Mich.
National Tube Co., Pittsburgh, Pa.

BOILER TUBES.
(Seamless Steel.)
Detroit Seamless Steel Tubes Co., Detroit, Mich.
National Tube Co., Pittsburgh, Pa.

BOILERS AND SUPERHEATERS.
Babcock & Wilcox Co., The, New York City.
Phoenix Iron Works Co., Meadville, Pa.
Vulcan Iron Works, Wilkesbarre, Pa.

BOLT AND NUT MACHINERY.
Baker Bros., Toledo, O.
Landis Machine Co., Waynesboro, Pa.
National Machinery Co., Tiffin, O.
Newton Mach. Tool Works, Inc., Philadelphia.
Williams Tool Co., Erie, Pa.

BOLTS.
(Heat Treated.)
Bethlehem Steel Co., The, South Bethlehem, Pa.

BOLTS AND NUTS.
American Bridge Co., New York City.
American Iron & Steel Mfg. Co., Lebanon, Pa.
Bayonne Bolt & Nut Co., Bayonne, N. J.
Beals & Company, Buffalo, N. Y.
Bourne-Fuller Co., Cleveland, O.
Clark Bros. Bolt Co., Milldale, Conn.
Lockhart Iron & Steel Co., Pittsburgh, Pa.
Milton Mfg. Co., Milton, Pa.
Oliver Iron & Steel Co., Pittsburgh, Pa.
Republic Iron & Steel Co., Youngstown, O.
Rockford Bolt Co., Rockford, Ill.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Ryerson, Jos. T., & Son, Chicago, Ill.
Scully Steel & Iron Co., Chicago, Ill.
Upson Nut Co., Cleveland, O.

BORING AND TURNING MACHINES.
Baker Bros., Toledo, O.
Cincinnati Planer Co., Cincinnati, O.
Espen-Lucas Machine Works, Philadelphia, Pa.
Mitts & Merrill, Saginaw, Mich.
Newton Mach. & Tool Wks., Inc., Philadelphia.
Niles-Bement-Pond Co., New York, N. Y.
Warner & Swasey Co., Cleveland, O.

BOXES.
(Case Hardening and Carbonizing.)
Blackwood Steel Fdy. Co., The, Springfield, O.

BOX STRAPPING.
(Steel.)
Acme Steel Goods Co., Chicago, Ill.

BRAKES.
(Electric.)
Cutler-Hammer Mfg. Co. The, Milwaukee, Wis.
Electric Controller & Mfg. Co., Cleveland, O.
General Electric Co., Schenectady, N. Y.
Toledo Bridge & Crane Co. Toledo, O.

BRASS AND COPPER.
Gardner, B. M., Co., Cleveland, O.

BRASS GOODS.
McKenna Brothers, Pittsburgh, Pa.

BRAZING OUTFITS.
Linde Air Products Co., New York, N. Y.
Oxweld Acetylene Co., Chicago, Ill.
Prest-O-Lite, The, Co., Indianapolis, Ind.

BRICK.
(Silica, Magnesia, Chrome.)
American Refractories Co., Chicago, Ill.
Kier Fire Brick Co., Pittsburgh, Pa.
Soisson, Jos., Fire Brick Co., Connellsville, Pa.
Union Mining Co., Mount Savage, Md.

BRICK INSULATING.
Armstrong Cork & Insulation Co., Pittsburgh.
Kieselguhr Co. of America, New York City.

BRIDGES.
(Suspension.)
Roebling's, John A., Sons Co., Trenton, N. J.

BRIDGES, BUILDINGS AND VIADUCTS.
(Steel.)
Alliance Structural Co., Alliance, O.
American Bridge Co., New York, N. Y.
Bellefontaine Bridge & Steel Co., The, Bellefontaine, O.
Blaw Steel Construction Co., Hoboken, Pa.
Eichleay, John, Jr., Co., Pittsburgh, Pa.
McClintic-Marshall Co., Pittsburgh, Pa.
McMyler Interstate Co., Cleveland, O.
Mt. Vernon Bridge Co., Mt. Vernon, O.
Riter-Conley Mfg. Co., Pittsburgh, Pa.

BRIQUETTING.
General Briquetting Co., New York, N. Y.

BRONZE.
(Manganese.)
American Manganese Bronze Co., Holmesburg, Philadelphia, Pa.
Bethlehem Steel Co., The, So. Bethlehem, Pa.

BUCKETS.
(Dumping.)
Atlas Car & Mfg. Co., The, Cleveland, O.

BUCKETS.
(Grab.)
American Bridge Co., New York, N. Y.
Brown Hoisting Machy. Co., Cleveland, O.
Industrial Works, Bay City, Mich.
Lakewood Engrg. Co., Cleveland, O.
Link-Belt Company, Chicago, Ill.
McMyler Interstate Co., Cleveland, O.
Orton & Steinbrenner Co., Chicago, Ill.
Pawling & Harnischfeger Co., Milwaukee, Wis.

BUGGIES.
(Wire.)
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

BULLDOZERS.
United Engrg. & Fdy. Co., Pittsburgh, Pa.

BUNDLERS—SCRAP, WIRE AND ROD.
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

BURNERS.
(Acetylene.)
Linde Air Products Co., New York, N. Y.
Oxweld Acetylene Co., Chicago, Ill.
Prest-O-Lite, The, Co., Indianapolis, Ind.

BURNERS.
(Fuel Oil.)
Gilbert & Barker Mfg. Co., Springfield, Mass.

BUSINESS CARDS.
(Engraved.)
Wiggins, John B., Co., Chicago, Ill.

BY-PRODUCT COKE OVENS.
Koppers, H., Co., Pittsburgh, Pa.

CABLEWAYS AND TRAMWAYS.
American Steel & Wire Co., Chicago, Ill.
Brown Hoisting Mchy. Co., Cleveland, O.
McClintic-Marshall Co., Pittsburgh, Pa.
Roebling's, John A., Sons, Co., Trenton, N. J.

CABLE WIRE.
Wright Wire Co., Worcester, Mass.

CANS.
(Waste, Shop and Oil.)
New Britain Mach. Co., New Britain, Conn.

CARBONIZING BOXES.
Blackwood Steel Fdy. Co., The, Springfield, O.

CARS.
(Coal and Ore Transfer.)
Atlas Car & Mfg. Co., The, Cleveland, O.

CARS.
(Coke-Quenching.)
Atlas Car & Mfg. Co., The, Cleveland, O.

CARS.
(Industrial and Mining.)
American Bridge Co., New York, N. Y.
American Steel Export Co., New York City.
Atlas Car & Mfg. Co., Cleveland, O.
Chase Fdy. & Mfg. Co., Columbus, O.
Lakewood Engrg. Co. Cleveland, O.
Mesta Machine Co., Pittsburgh, Pa.
Whiting Fdy. Equipment Co., Harvey, Ill.

CARS.
(Scale.)
Atlas Car & Mfg. Co., The, Cleveland, O.

CARS.
(Steel.)
Cambria Steel Co., Philadelphia, Pa.

CASE HARDENING.
Bidle, W. S., Co., Cleveland, O.
Roberts Mfg. Co., Lockport, N. Y.

CASE HARDENING BOXES.
Blackwood Steel Fdy. Co., The, Springfield, O.

CASTINGS.
(Air Furnace.)
Mesta Machine Co., Pittsburgh, Pa.
Tod, Wm., Co., Youngstown, O.

CASTINGS.
(Alloy Steel.)
Blackwood Steel Fdy. Co., The, Springfield, O.
Sivyer Steel Casting Co., Milwaukee, Wis.

CASTINGS.
(Brass, Bronze and Aluminum.)
American Manganese Bronze Co., Holmesburg, Philadelphia, Pa.
Arcade Mfg. Co., Freeport, Ill.
Bellefonte Engineering Co., Bellefonte, Pa.
Dake Engine Co., Grand Haven, Mich.
Hill Pump Valve Co., Chicago, Ill.
Keystone Bronze Co., Pittsburgh, Pa.
Klotz Machine Co., Sandusky, O.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
S. C. Regulator Company, Fostoria, O.
Scranton Pump Co., Scranton, Pa.
Titanium Alloy Mfg. Co., Niagara Falls, N. Y.
Tod, Wm., Co., Youngstown, O.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
Wellman Bronze Co., Cleveland, O.

CASTINGS.
(Chilled.)
Lehigh Car, Wheel & Axle Works, Catasauqua, Pa.
McLain's System, Inc., Milwaukee, Wis.

CASTINGS.
(Converter Steel.)
Reading Steel Casting Co., Reading, Pa.
Sivyer Steel Casting Co., Milwaukee, Wis.
West Steel Casting Co., Cleveland, O.

CASTINGS.
(Crucible Steel.)
Sivyer Steel Casting Co., Milwaukee, Wis.
West Steel Casting Co., Cleveland, O.

CASTINGS.
(Die.)
Atlas Steel Casting Co., Buffalo, N. Y.
Lubricating Metal Co., The, New York City.
Strong Steel Foundry Co., Buffalo, N. Y.

CASTINGS.
(Electric Furnace.)
Belle City Malleable Iron Co., Racine, Wis.
Latrobe Electric Steel Co., Latrobe, Pa.
Sivyer Steel Casting Co., Milwaukee, Wis.
Treadwell Engrg. Co., Easton, Pa.
United Alloys Steel Corp., The, Canton, O

CASTINGS.
(Furnace.)
Marshall Foundry Co., Pittsburgh, Pa.

CASTINGS.
(Gear.)
Allyne-Ryan Foundry Co., Cleveland, O.
Dayton Steel Foundry Co., Dayton, O.
Link-Belt Company, Chicago, Ill.
Mesta Machine Co., Pittsburgh, Pa.
Sivyer Steel Casting Co., Milwaukee, Wis.
Standard Steel Castings Co., Cleveland, O.
Strong Steel Foundry Co., Buffalo, N. Y.
Taylor-Wilson Mfg. Co., McKees Rocks, Pa
United Engrg. & Fdy. Co., Pittsburgh, Pa.

CASTINGS.
(Gray Iron.)
Adamson Machine Co.,
American Bridge Co., New York, N. Y.
Arcade Mfg. Co., Freeport, Ill.
Bethlehem Steel Co., So. Bethlehem, Pa.
Birdsboro St'l Fdy. & Mch. Co., Birdsboro, Pa.
Buffalo Fdy. & Machine Co., Buffalo, N. Y.
Cyclops Foundry Co., Pittsburgh, Pa.
Dake Engine Co., Grand Haven, Mich.
Erie Foundry Co., Erie, Pa.
Farrell Foundry & Mach. Co., Ansonia, Conn
Klotz Machine Co., Sandusky, O.
Link-Belt Company, Chicago, Ill.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Marshall Foundry Co., Pittsburgh, Pa.
Metals Production Equipment Co., Springfield, Mass.
Murray Iron Works Co., Burlington, Iowa.
National Foundry Co., Erie, Pa.
North Buffalo Hdw. Fdy. Co., Buffalo, N. Y.
Phoenix Iron Works Co., Meadville, Pa.
Scranton Pump Co., Scranton, Pa.
Standard Engrg. Co., Ellwood City, Pa.
Standard Foundry Co., Buffalo, N. Y.
Taylor-Wilson Mfg. Co., McKees Rocks, Pa.
Tod, Wm., Co., Youngstown, O.
Treadwell Engineering Co., Easton, Pa.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
U. S. Cast Iron Pipe & Fdy. Co., Burlington, N. J.
Winslow Brothers Co., Chicago, Ill.
Youngstown Sh't & Tube Co., Youngstown, O.

CASTINGS.
(Malleable.)
Acme Steel & Malleable Iron Wks., Inc., Buffalo, N. Y
Belle City Malleable Iron Co., Racine, Wis.
Columbus Malleable Iron Co., Columbus, O.
Danville Malleable Iron Co., Danville, Ill.
Dayton Malleable Iron Co., Dayton, O.
Erie Malleable Iron Co., Erie, Pa.
Illinois Malleable Iron Co., Chicago, Ill.
Lakeside Malleable Castings Co., Racine, Wis.
Link-Belt Company, Chicago, Ill.
Marion Malleable Iron Works, Marion, Ind.
Missouri Malleable Iron Co., E. St. Louis, Ill.
Moline Malleable Iron Co., St. Charles, Ill.
National Malleable Castings Co., Cleveland, O.
Northwestern Mal. Iron Co., Milwaukee, Wis.
Pittsburgh Malleable Iron Co., Pittsburgh, Pa.
Pittsburgh Valve Foundry & Const. Co., Pittsburgh, Pa.
Ross-Meehan Foundries, Chattanooga, Tenn.
Standard Malleable Iron Co., Muskegon, Mich.
Wisconsin Malleable Iron Co., Milwaukee, Wis.
Zanesville Malleable Iron Co., Zanesville, O.

CASTINGS.
(Manganese Steel.)
Bethlehem Steel Co., The, South Bethlehem, Pa.
St. Louis Steel Foundry, St. Louis, Mo.
Smith, Geo. H., Steel Casting Co., Milwaukee, Wis.
Strong Steel Foundry Co., Buffalo, N. Y.
Taylor-Wharton Iron & Steel Co., Highbridge, N. J.

CASTINGS.
(Semi-Steel.)
Adamson Machine Co., Akron, O.
Allyne-Ryan Fdy. Co., Cleveland, O.
Buffalo Fdy. & Mch. Co., Buffalo, N. Y.
Pittsburgh Piping & Equip. Co., Pittsburgh.
Tod, Wm., Co., Youngstown, O.
United Engrg. & Fdy. Co., Pittsburgh, Pa.

See Index to Advertisements for Pages Containing Advertisements of Companies Listed Above

In Population Sixth

In Manufacturing Fifth

Cleveland— The Industrial Giant

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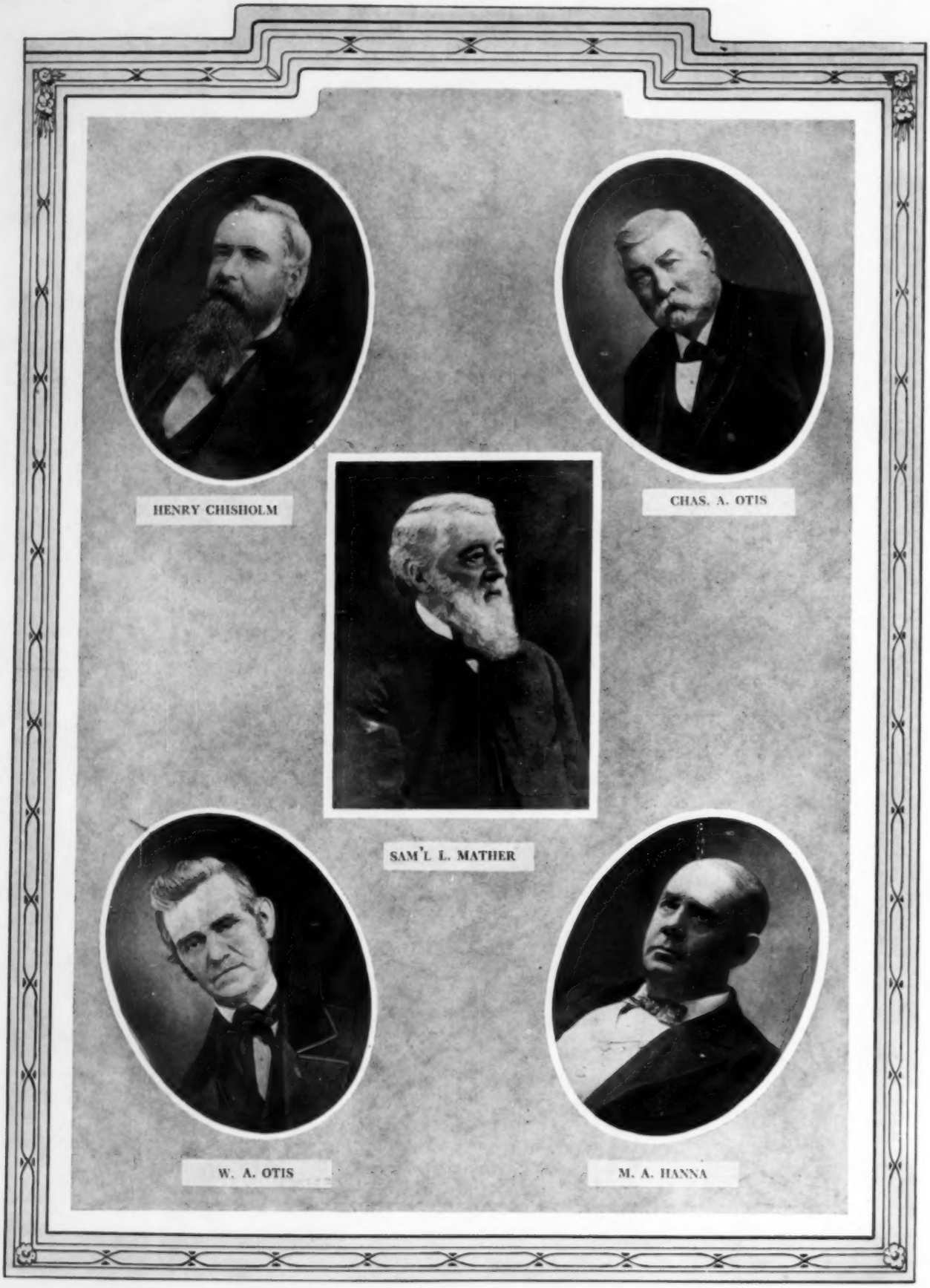


MEN WHO LAID BROAD AND SOLID FOUNDATIONS OF THE IRON INDUSTRY IN CLEVELAND

Cleveland–Home of Many Industries

Iron and steel making, built upon solid foundations by far-seeing men, develops magnificently while many other lines of manufacturing also become important factors in the progress of the metropolis of Ohio

BY GEORGE SMART

CLEVELAND has been described in various terms, according to the point of view of different people. Many years ago, it was christened the Forest City on account of its beautiful avenues shaded by countless trees. Tom L. Johnson was fond of speaking of it as the City on a Hill. It has often been referred to as the city of civic consciousness and independent thinking. The Cleveland Chamber of Commerce, after hearing the report of the census of 1910, began to popularize the use of the words "Cleveland, the Sixth City", for it is in population the metropolis of Ohio and the sixth city of the United States. But the census also disclosed that Cleveland was the fifth city in the country in manufactured products, and it certainly is true that, speaking from the standpoint of manufacturing, Cleveland is best described by the term "The City of Diversified Industries". One great source of strength of the city lies in its success in carrying on many industries. Cleveland's prosperity does not depend upon that of any particular industry. Hence it often is enjoying very fair prosperity when other cities are suffering from extreme depression. Unfortunately the latest definite and reliable statistics in regard to Cleveland's industries are those for 1914, and since that year the increase has been very decided. The value of the production of all industries in Cleveland in 1914, as reported by the bureau of the census, was $352,531,000, and in the 10 years from 1904 to 1914, the increase was slightly more than 105 per cent. The increase since 1914 has probably been fully 100 per cent.

The iron and steel business in Cleveland developed rapidly during the civil war and in the years following, especially during the past decade. The census of 1914 shows that the city then had 43 iron and steel plants with 12,906 as the average number of employes and producing products valued at $58,752,016. It also had 267 foundries and machine shops, employing 22,301 wage earners and turning out products valued at $50,951,012. There were 40 plants manufacturing electrical machinery, apparatus and supplies, with 3,326 wage earners and production valued at $11,357,538.

Among the leading industries of Cleveland are the following:

The American Steel & Wire Co., with 6,000 as the average number of employes and the following plants and products:

American Works—140,000 tons of rods and 65,000 tons of wire.

Consolidated Works—110,000 tons of rods, 93,000 tons of wire and 1,160,000 kegs of nails.

H. P. Works—33,000 tons of rods, 60,000 tons of wire, 1,130,000 kegs of nails and tacks and 8,000 tons of spikes and pole steps.

Cuyahoga Works—33,000 tons of rods and 33,000 tons of wire.

Newburgh Steel Works — 935,000 tons of ingots, 825,000 tons of billets and 120,000 tons of rods.

Newburgh Wire Works — 100,000 tons of wire and 15,000 tons of shafting.

The Otis Steel Co., employing about 1,950 men and turning out at the Lakeside plant about 125,000 net tons of steel plates, castings and forgings, and 115,000 net tons of plates and sheets at the new Riverside plant.

The Lake Erie Iron Co., 50,000 tons of iron and steel bolts and nuts, employing 1,100 men.

Cleveland Steel Co., 30,000 tons of light plates and sheets.

Upson Nut Co., employing about 2,500 men and having an annual output of 80,000 tons of pig iron, 200,000 tons of ingots and 100,000 tons of steel bars.

Union Rolling Mill Co.—70,000 tons of iron and steel bars.

Empire Rolling Mill Co. — 50,000 tons of iron and steel bars.

Cleveland has 11 blast furnaces, of which five belong to the American Steel & Wire Co., one to the Upson Nut Co., three to Corrigan, McKinney & Co., and two to the Cleveland Furnace Co., the 11 having an output of about 150,000 tons per month. The fourth stack of Corrigan, McKinney & Co. will soon be blown in. The greatness of the iron business of Cleveland is due to a large extent to the solid foundations upon which it was built and in laying these foundations broad and deep,

Growth of Cleveland Industries

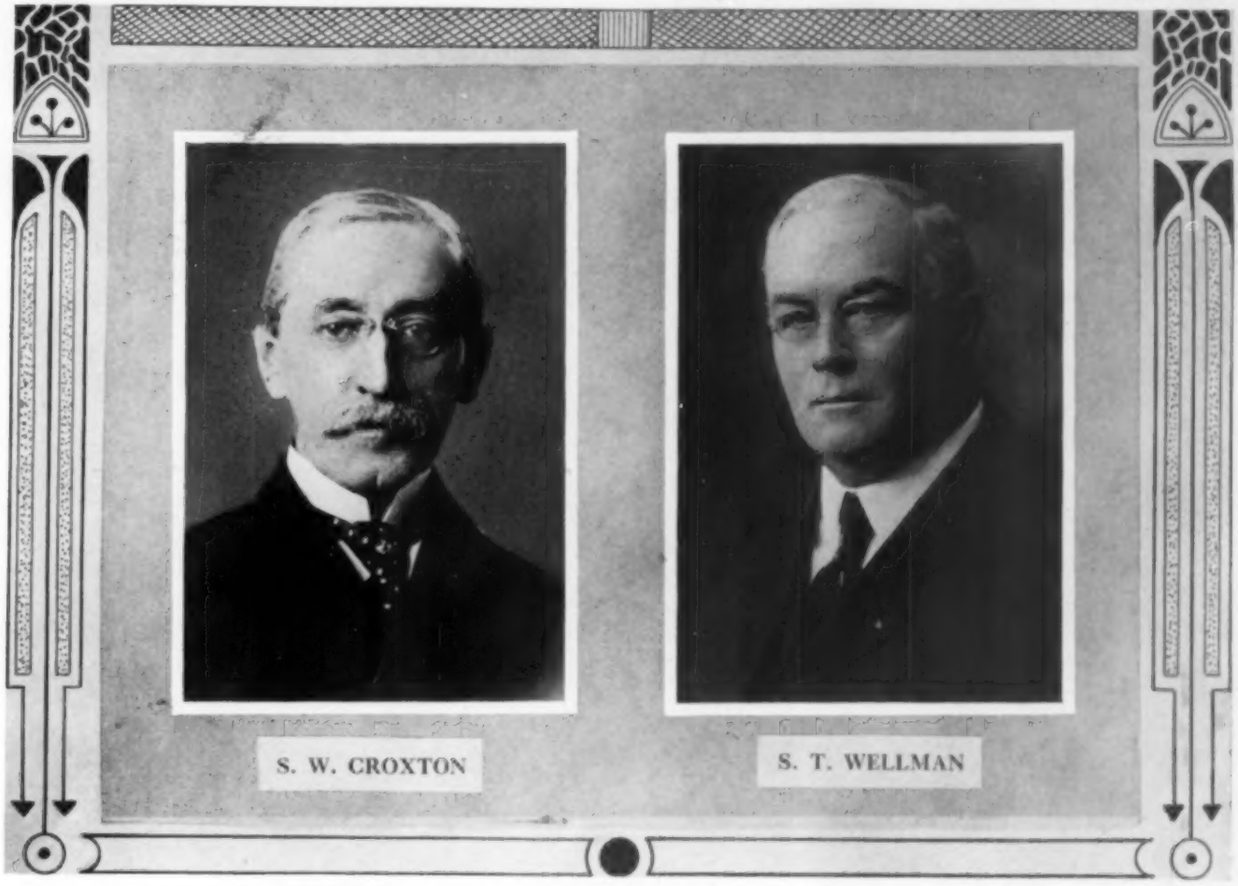
(Statistics Compiled by the Bureau of the Census for 1909-1914.)

Industry.	Value of products 1914.	Percentage of increase 1909-1914.	Percentage of increase 1904-1914.
All industries	$352,531,000	29.6	105.1
Automobiles, including bodies and parts	27,117,000	160.3	486.4
Boxes, fancy and paper	1,468,000	28.7	248.7
*Brass and bronze products	2,359,000	*8.1	59.3
Bread and other bakery products	6,908,000	46.0	131.7
Brick and tile	1,023,000	33.0	195.7
Cars and general shop construction and repairs by steam railroad companies	4,958,000	141.1	194.9
Chemicals	3,130,000	67.7	130.0
Clothing, men's including shirt	9,546,000	60.4	220.4
Clothing, women's	16,243,000	27.0	118.7
Confectionery	4,965,000	74.1	189.5
Cooperage and wooden goods not elsewhere spec.	855,000	20.8	118.1
Copper, tin and sheet iron products	3,865,000	30.3	433.8
Cutlery and tools not elsewhere specified	3,684,000	53.8	200.9
Electrical machinery, apparatus and supplies	11,358,000	181.4	328.1
Foundry and machine shop products	50,951,000	36.1	112.0
Furniture and refrigerators	1,595,000	49.0	66.0
Gas and electric fixtures and lamps and reflectors	974,000	48.9	71.2
Hosiery and knit goods	4,051,000	37.0	107.0
Iron and steel, steel works and rolling mills	58,752,000	52.7	82.0
Leather and leather goods	1,462,000	61.2	535.7
Liquors, malt	6,528,000	27.4	63.8
Lumber and timber products	4,916,000	22.3	28.7
*Millinery and lace goods	1,150,000	*4.6	882.8
Paint and varnish	10,093,000	64.4	172.8
Patent medicines and compounds and druggists' preparations	2,140,000	111.9	402.3
Printing and publishing	14,099,000	46.3	129.6
Slaughtering and meat packing	24,737,000	43.9	133.0
Stoves and furnaces, including gas and oil stoves	8,621,000	73.2	186.9
*Tobacco manufactures	2,666,000	*3.7	39.1

*Denotes decreases.

SALES MANAGERS OF COMPANIES WHOSE IRON AND STEEL PRODUCTS ARE SOLD EXTENSIVELY IN THE CLEVELAND DISTRICT

four men were most prominent, Samuel Livingstone Mather, Henry Chisholm, Charles A. Otis and Marcus A. Hanna. They were sturdy, far-seeing men and their names will be forever identified with the iron industry of Cleveland, not only because of what they did, but also on account of what their descendants have done and are doing to bring that industry to a greater stage of development. William A. Otis, the father of Charles A., was also a prominent factor in the early days of iron-making in Cleveland—then only a large village.



CLEVELAND MEN WHO HAVE BEEN PROMINENT FACTORS IN THE PROGRESS OF THE IRON AND STEEL BUSINESS
(Mr. Croxton was one of the organizers of the Cleveland Furnace Co. and vice president from 1902 to 1906. Mr. Wellman was one of the organizers of the Wellman-Seaver-Morgan Co. and long its president.)

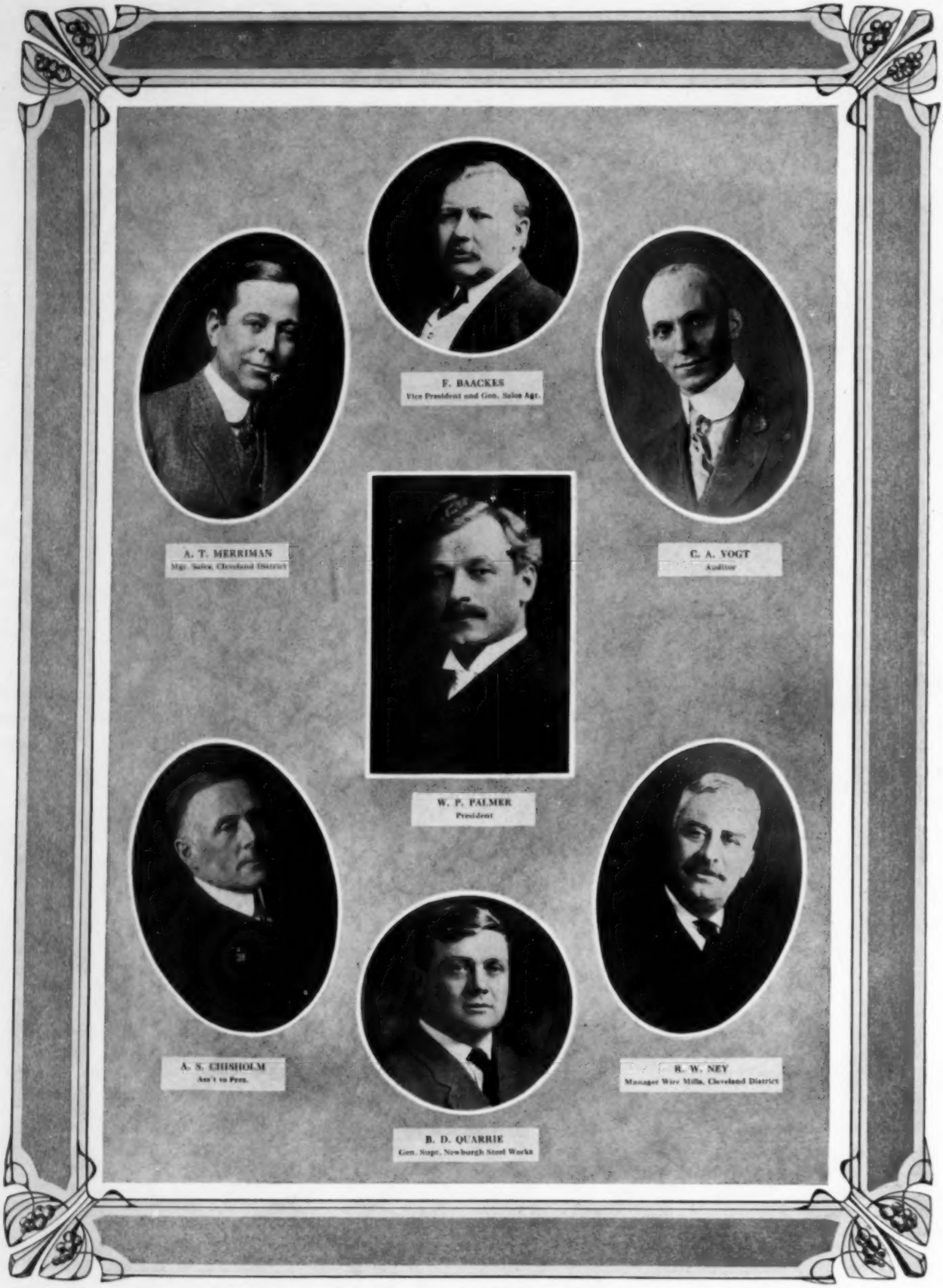
Samuel Livingstone Mather was born in Middletown, Conn., and was graduated from Wesleyan University of that city in his sixteenth year. Soon afterwards he became engaged in business in New York City as an importer and exporter, and made a number of trips to Spain. This business did not prove profitable, and to that fact, which then seemed very unfortunate, was due his decision to make the trip to Ohio, where in the neighborhood of Ashtabula his father and some friends of the family held some lands which had been obtained from the historical Connecticut Land Co., for which he had acted as an agent. He studied law and was admitted to the bar, but never practiced. In the late 40's when ore was discovered in the Lake Superior region, he became connected with the enterprise which developed a few years later into the Cleveland Iron Mining Co., and after serving for several years as secretary and treasurer, he became its president. This company was the first to bring a cargo of ore from Michigan to Cleveland. It continued to mine and ship ore regularly after the first ore was delivered, and in 1890 the Iron Cliffs Co., which also owned ore property in fee and operated mines and charcoal iron furnaces in territory adjacent to that of the Cleveland Iron Mining Co., was acquired and a new company formed, called the Cleveland-Cliffs Iron Co., with which organization the Cleveland Iron Mining Co. and Iron Cliffs Co. were consolidated.

Mr. Mather's delightful personality; his dignity and charm of manner; his unfailing fairness and liberality towards all; and his high character made a strong impression on his associates. He was a marked factor in molding the general lines upon which the great Lake Superior iron mining industry has been conducted.

Mr. Mather's son, Samuel Mather, was associated with his father for a number of years before the latter's death, which occurred in 1890, and is the senior member of the firm of Pickands, Mather & Co., which was established by Samuel Mather, James Pickands and J. C. Morse.

Wm. G. Mather, son of Samuel L. Mather and brother of Samuel Mather, is president of the Cleveland-Cliffs Iron Co. and vice president of the Cleveland Furnace Co.

Even when Cleveland was a small village, there were far-seeing residents of the future metropolis of Ohio who had keen appreciation of its possibilities. These men looked with special favor on the building of the Ohio canal from Cleveland to Portsmouth, and when the canal was completed in the early 30's, the assertion was made that Cleveland ought to stop almost entirely the bringing of manufactured products, especially iron and steel, from east of the mountains. For even prior to the opening



OFFICIALS OF THE AMERICAN STEEL & WIRE CO., WHOSE GREAT CLEVELAND PLANT IS THE SUCCESSOR OF THE WORKS FOUNDED BY HENRY CHISHOLM

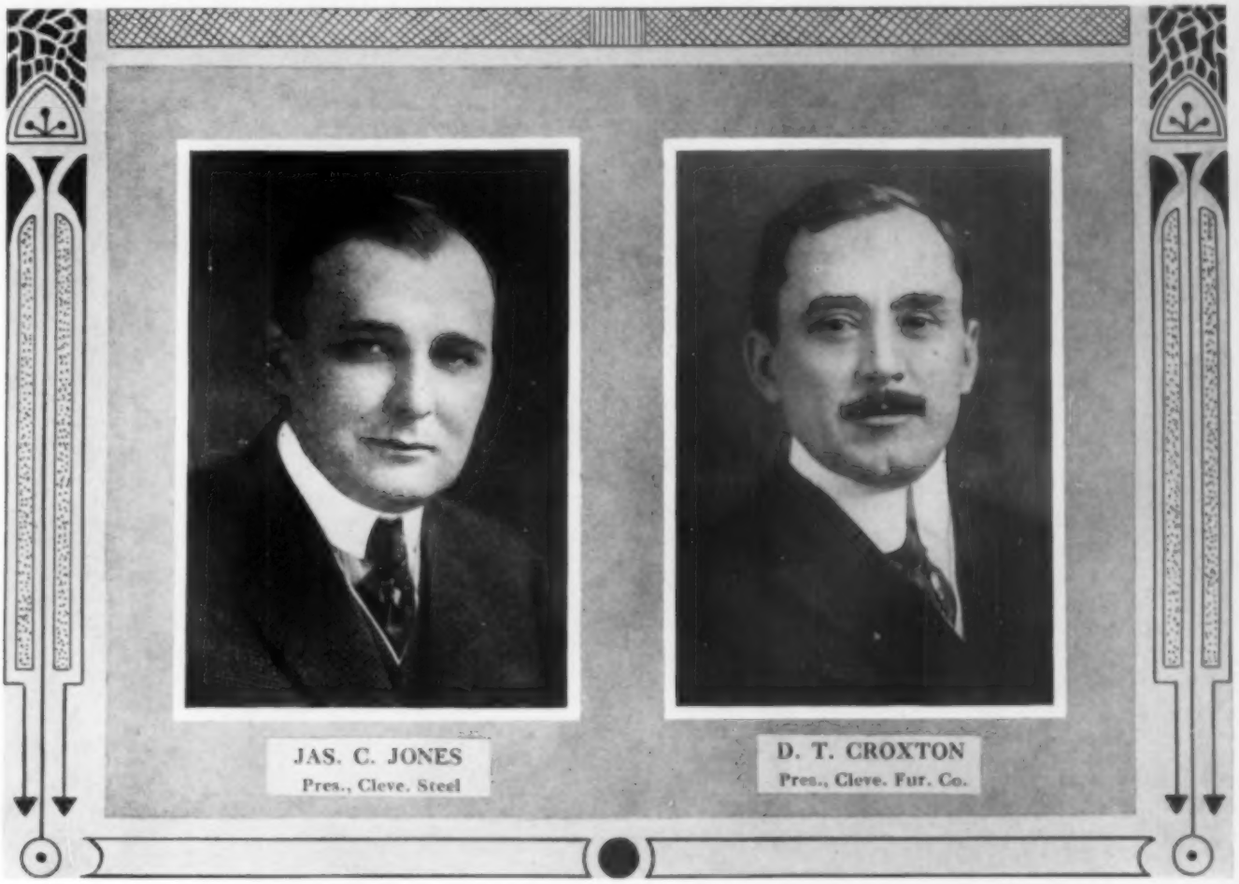
of the canal, the beginning of two of Cleveland's greatest sources of wealth, coal and iron, was recorded.

In 1828, John Ballard & Co. started a little iron foundry, and somewhat later Henry Newberry shipped from his land near the canal a few tons of coal. An attempt was made to introduce coal as the fuel of Cleveland. A wagon load was driven from door to door, and its good qualities explained. "No one," says one chronicler, "wanted it. Wood was plenty and cheap and the neat housewives of Cleveland especially objected to the dismal appearance and dirt-creating qualities of the new fuel."

Following a period of inflation and financial disaster, Cleveland emerged and looked hopefully to the future in 1840, when her population was about 7,000. In that year, William A. Otis established an iron works, the first of any importance in the village, and thus encouraged local manufacturing. Coal mining had developed somewhat and Cleveland had become something of a market for that product. A more important development in the iron business was inaugurated in 1857, of which Charles A. Otis, son of Wm. A. Otis, long a prominent iron manufacturer of Cleveland, has written: "The first rolling mill at Cleveland was a plate mill, worked on a direct ore process, which was a failure. It went into operation in 1854 or 1855. The mill is now (1884) owned by the Britton Iron & Steel Co. The next mill was built in 1856, by A. J. Smith and others, to reroll rails. It was called the Railroad Rolling Mill, and was later owned by the Cleveland Rolling Mill Co. At the same time, a man named Jones, with several associates, built a mill at Newburg, six miles from Cleveland, also to reroll rails. It was afterward operated by Stone, Chisholm & Jones, and is now owned by the Cleveland Rolling Mill Co. In 1852, I erected a steam forge, to make wrought iron forgings, and in 1859, I added to it a rolling mill, to manufacture merchant bar, etc. The Union Rolling Mills were built in 1861 and 1862, to roll merchant bar iron."

The service of Henry Chisholm was indeed very great and he occupies a foremost place in the history of the iron industries of Cleveland. He was a sturdy Scotchman, born in the land of the heather in 1822, and came to America when 20 years of age. He was a carpenter and followed that trade in Montreal. In 1850, he was employed in Cleveland, and soon after settled permanently in this city. His start in the manufacture of iron was made in the old town of Newburgh, where he engaged in the manufacture of bar iron and established the foundation of what became the great Cleveland Rolling Mill Co., which in time came to employ a large number of men and turn out annually 150,000 tons of finished product. The plant is now a part of the property of the American Steel & Wire Co.

Speaking of Mr. Chisholm, one who was thoroughly familiar with his career has said: "He was among the early ones to see that steel rails would entirely take the place of iron, and one of the first to make a commercial success of the bessemer process in this country. But where his signal ability most completely displayed itself was in recognizing the fact that, for the highest prosperity, a steel mill should have more than 'one string to its bow,' and that tr



TWO OF THE YOUNGER LEADERS OF THE IRON AND STEEL BUSINESS OF CLEVELAND

Mr. Jones started with the Cleveland Steel Co. as an office boy and, with his associates, purchased the Rockefeller Foundation's controling interest a few months ago. Mr. Croxton has been president of the Cleveland Furnace Co. a number of years and active in the business life of the city.

PROMINENT CLEVELAND MEN OF THE GREAT LAKES TRANSPORTATION INTERESTS

run in all times, under all circumstances, bessemer steel must be adapted to other uses than the making of rails. Holding tenaciously to this idea, he was the first to branch out into the manufacture of wire, screws, agricultural and merchant shapes, from steel. To the progress in this direction must be imputed a large share of the success of his company, and it further entitles Mr. Chisholm to be regarded as one of the greatest, if not the greatest man, who has been engaged in the bessemer steel manufacture in this country. It is rare, indeed, that mechanical skill and business ability are united in one and the same individual and it was to this exceptional combination of talents that Mr. Chisholm owed his more than splendid success. A Scotchman by birth and nature, and loving the poems of his nation's bard with an ardor that only a Scot can feel, he became as thorough an American citizen as if he had drawn his inspiration from Plymouth Rock, and he performed his civic duties with an ever-serene confidence in the merit of our institutions."

Although the auspicious beginning in the manufacture of iron was made under the direction of Mr. Chisholm, it was not until ore shipments were started from the Lake Superior regions that the industry began to assume large proportions. It was in 1846 that Cleveland parties appeared on the scene and opened the way for the immense business that has grown up between that region and this city. Dr. J. Lang Cassels, of Cleveland, visited Lake Superior in 1846, and took "squatter's possession" in the name of the Dead River Silver & Copper Mining Co. of Cleveland—an enterprise in which were many of the men afterward found in the Cleveland Iron Co. He was guided to the desired location by an Indian, and made the journey thereto and return, from the nearest settled point, in a birch bark canoe. In the following year, he left that country and returned to Cleveland, where he made a mild prophecy as to the mineral wealth of the Superior region, which was received with general incredulity.

The Cleveland Iron Co. was formed in 1849, but did little business in the Superior country until 1853. Its first organization was under a special Michigan charter, but on March 29, 1853, it filed articles of association under the name of the Cleveland Iron Mining Co., with a capital stock of $500,000. The incorporators were John Outhwaite, Morgan L. Hewitt, Selah Chamberlain, Samuel L. Mather, Isaac L. Hewitt, Henry F. Brayton and E. M. Clark. The office was located at Cleveland, and some of the lands of which it became possessed now comprise the principal part of the city of Marquette. In 1854, the Cleveland company mined 4,000 tons of ore, which was made into blooms at the different forges in the vicinity, and sent to the lower lake points, some of it coming to this city.

This company, from the day of its origin, was looked upon as one of the most solid and important of the commercial concerns of Cleveland. It had much to do with creating and fostering the iron interests of Ohio and western Pennsylvania. The first cargo of ore to this point was brought in 1856, and sold in small lots to such parties as were willing to give it an experimental trial.

It should also be said in this connection that the first ore from that section was shipped to Cleveland in 1852, by the Marquette Iron Co., in a half dozen barrels, aboard the ship Baltimore. The low estimation in which the ore was held by this business community during the experimental stages is illustrated by the following incident related by George H. Ely. He was living in Rochester, N. Y., where he held the position of president of the Lake Superior Iron Co. A small cargo of ore had been shipped to a Cleveland party who was unable to pay the freight and so little commercial value was attached to the iron that the whole cargo was not considered sufficient security for the freight charges and Mr. Ely was drawn on before they could be paid.

One of the most important features of Cleveland industries is ship building. The first iron bulk freight steamer intended for the carrying of ore and grain was Onoko, built by the Globe Iron Works, Cleveland, in 1882. The vessel was 287 feet long, 38-foot 6-inch beam, and 28 feet 8 inches deep, and had a carrying capacity of 3,600 tons. She foundered off Duluth in September, 1915. Now steamers carrying 12,000 tons have become rather common. There are many vessels 600 feet long. The tonnage moved on the Great Lakes increased from 11,597 in 1856, to 49,070,478 in 1913, with an excellent prospect of 60,000,000 tons being moved this year.

Cleveland is noted not only on account of the products manufactured within its limits, but also on account of the very prominent position of its iron mining and selling companies, such as Pickands, Mather & Co., M. A. Hanna & Co., Oglebay, Norton & Co., Tod-Stambaugh Co., the Cleveland-Cliffs Iron Co., and E. N. Breitung & Co., which every year mine and market many millions of tons of ore. Several of these firms are also very large producers of pig iron through their affiliated interests and sell the product through their Cleveland offices.

In the development of mining and shipping of Lake Superior ore, one of the most conspicuous figures was

(*Concluded on page 70.*)

Products of Cleveland Plants Manufacturing Iron and Steel and Other Products in 1914

(Compiled by the Bureau of the Census.)

Cleveland.	Total all industries.	Automobiles including bodies and parts.	Iron and steel.	Foundry and machine shop products.	Electrical machinery, apparatus and supplies.
No. of establishments.....	2,346	36	43	267	40
Persons engaged in mfctrs..	122,793	7,977	14,428	25,554	4,016
Proprietors & firm members	1,693	15	5	102	18
Salaried employes	17,766	956	1,517	3,151	672
Wage earners av. No.....	103,334	7,006	12,906	22,301	3,326
Primary horsepower	277,066	10,867	124,164	39,107	4,831
Capital .....$	312,967,444	$23,633,040	$67,362,948	$58,958,052	$11,330,192
Salaries and wages.....	92,909,888	7,112,554	11,856,806	20,282,755	2,827,043
Salaries	25,544,754	1,741,395	2,465,530	5,096,288	878,805
Wages	67,365,134	5,371,159	9,391,276	15,186,467	1,948,238
Rent and taxes.....	6,684,637	252,415	466,053	722,578	76,371
Cost of materials.....	198,514,988	14,731,674	42,914,277	20,869,301	5,891,571
Value of products.....	352,531,109	27,116,595	58,752,016	50,951,012	11,757,538

Note:—The column "Iron and Steel" includes—blast furnaces; iron and steel, steel works and rolling mills; iron and steel, bolts, nuts, washers and rivets; iron and steel forgings; iron and steel nails, spikes, etc., cut and wrought, including wire nails not made in steel works or rolling mills; tin plate and terne plate; wire (mills purchasing the rod from which the wire is drawn.)

The column "Foundry and Machine Shop Products" includes automobile repairing with power; engines, steam, gas and water, also gasoline; foundry and machine shop products; gas machines and gas and water meters; hardware; iron and steel, cast iron pipe; plumbers' supplies; pumps, steam, steam fittings and heating apparatus; structural iron work.

Cleveland Makes Much Machinery

The City's immense number of manufactories has attracted many builders of machine tools—Cleveland is recognized the world over as a leader in producing special, heavy machine tools and ore handling equipment

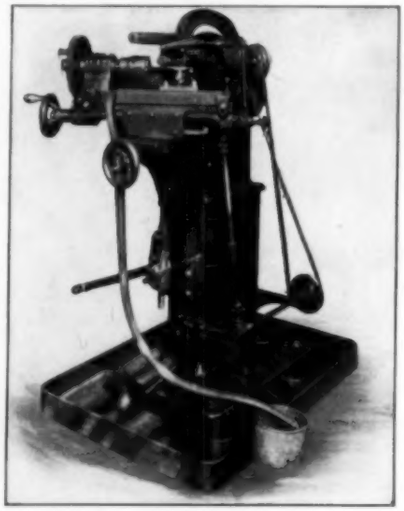
BY W. S. DOXSEY

EARLY machine tool manufacturing in the United States was confined to the New England section, where the proficiency of the Yankee tool builders progressed until their competition was keenly felt in Europe. This was only twenty years after the industry was established in the United States. But it was not until the early eighties that eastern manufacturers recognized any competition by the machine tool builders of the middle west. Prior to this period such tools as were made in the Great Lakes district were of mediocre quality and only partially supplied the local demand. Since that time tremendous strides have been made, and among other centers, Cleveland, centrally located on the south shore of Lake Erie, has become one of the world's leading manufacturing centers.

The machine tool and shop equipment industry, which at the present time leads in Cleveland in the salaries paid to employes and is second only to the iron and steel industry in the value of its products, was founded in a little shop near the Cuyahoga river. The equipment consisted of two lathes and a drill press; the working force, a man and a boy. The proprietors of this shop, Cox and Newton, like a majority of the pioneers of this Cleveland industry, were both practical men. Their partnership was formed to establish a twist drill business, but being unable to obtain proper machine tools for making drills, they were forced to build several milling machines and planers for their own use. The first milling machine built in Cleveland, which was made in 1878, is still in service in the plant of the Cleveland Twist Drill Co. It is shown in an accompanying illustration.

Cox and Newton were soon called upon to supply machines for other local manufacturers and for some years did a brisk business building millers and planers in addition to their regular business of making drills. The twist drill business, however, soon grew to such proportions that the company discontinued the manufacture of machine tools and confined its efforts along the lines of its original intentions. A Cincinnati planer was developed from the paterns sold at this time as was one of the well-known milling machines. In 1880, C. C. Newton sold his share of the business to F. F. Prentiss and started in business for himself in Philadelphia.

Two of the most important factors which have influenced the growth of the machinery manufacturing industry in Cleveland have been the large requirements of local manufacturers and the healthy condition of the labor market in this city. Cleveland's favorable location, from an industrial viewpoint, has attracted many industries whose needs have had a far reaching effect upon the tool-building industry.



ONE OF THE FIRST MACHINE TOOLS MADE IN CLEVELAND—A MILLING MACHINE BUILT IN 1878

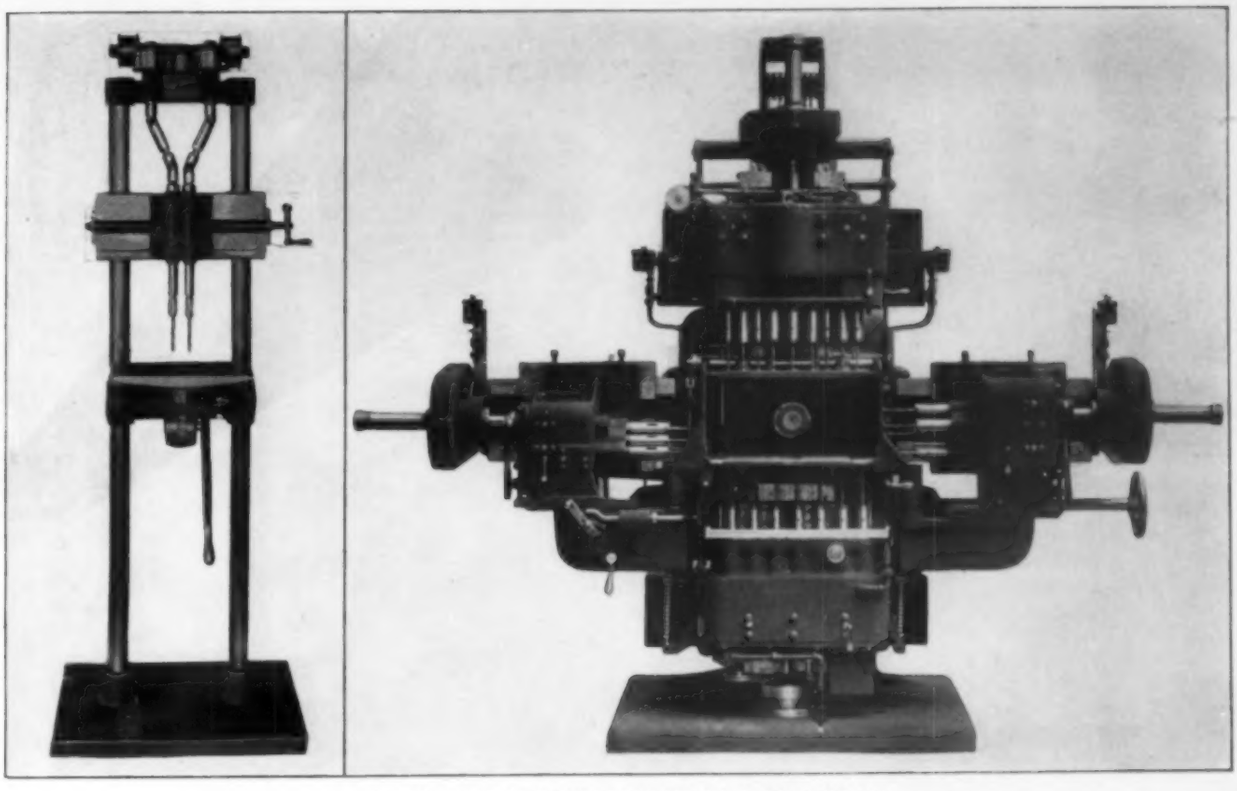
Although the first railroad did not enter Cleveland until 1850 and the first iron ore was not received at this port until three years later, the score of years that followed saw the city develop into a manufacturing center of no mean proportions. Located midway between the coal fields and the iron ore deposits, it was natural that Cleveland products should be principally of iron and steel. Certain of the industries peculiar to Cleveland exerted a decided influence in determining the characteristic types of the machine tools and other machinery now built in the city. Among these, of prime importance are the screw, nut and bolt, the ship building, and the iron ore and coal shipping industries.

Catering to Specialized Industries

The Cleveland Punch & Shear Works, dating from 1880, and the Acme Machinery Co., from 1884, were among the first firms to cater to the specialized industries of Cleveland. F. W. Bruch, who received his early training at the Novelty Iron Works, Cleveland, figured prominently in the early history of both of these companies. It is interesting to note that a number of the men whose names are associated with the early development of the machinery manufacturing industry in Cleveland, came from the shop of one of the large tool builders of the east. Of historical interest in this group are W. R. Warner and Ambrose Swasey, who located first in Chicago, and a year later, in 1882, moved to Cleveland because of better labor conditions. Their first order was for 12 turret lathes and they have specialized on this type of machine ever since. The shop of Warner & Swasey served as a stepping stone for a number of Cleveland machine tool builders whose experience with this firm assisted them later to establish their own manufacturing plants. Among these men are H. M. Lucas, George Bardons, John Oliver and Frank Kempsmith, all of whom figured prominently in Cleveland's industrial expansion and development. The Standard Tool Co., which was founded in 1882, together with the Cleveland Twist Drill Co. are said to manufacture at the present time more twist drills than the combined production of the rest of the world.

Where Automatic Screw Machines are Made

Cleveland is recognized as one of the leading centers of the world for the manufacture of automatic screw machines and their products. The first multi-spindle automatic screw machines are said to have been developed in the shop of the White Sewing Machine Co. for its own use. These machines proved so successful



A WONDERFUL DEVELOPMENT IN A FEW YEARS

The machine at the left represents the type of multiple-spindle drill press first built in 1900—The machine at the right is a new model performing 45 operations at once

that a separate company was organized for their manufacture. The Acme automatic owes its origination to the bicycle industry. This machine was invented in the east and was later brought to Cleveland for manufacture. Another machine, typical of the products of Cleveland tool builders, is the multi-spindle drill press. It is believed the first machine of this character was made in the Cleveland district. It had but two spindles. An interesting contrast is shown in an accompanying illustration. The small machine to the left is one of the first multi-spindle presses made; the large machine at the right pictures the latest development. It performs 45 drilling operations at once.

Conveying Machinery

More recent years have seen established in Cleveland several companies which have confined their efforts to the production of stationary and traveling cranes and various kinds of conveying machinery. Two Cleveland manufacturers have supplied together more than 90 per cent of the ore handling machinery now in use at the ports of the Great Lakes.

Already firmly established as leaders in the world's production of special, heavy machine tools, Cleveland manufacturers were able to supply a large proportion of the machines used by motor car builders when the establishment and growth of that industry created new markets for tools.

Conservative estimates from the most reliable sources place the total capital investment of over 200 builders of machine tools and shop equipment in Cleveland at more than $40,000,000. This figure, like those which follow, includes only those concerns which manufacture machinery and does not include makers of screws, nuts, bolts and similar products. The annual production of these manufacturers is valued at approximately $85,000,000, although this figure is subject to variation with changes in the industrial and financial conditions of the country. The number of wage earners employed in this industry exceeds 45,000 and the yearly payroll under ordinary conditions is close to $40,000,000.

Makes Special Tools

One of the most remarkable features of the Cleveland machine tool industry, considering its proportions and the fact that the city is centrally located in the manufacturing district of the United States and is itself a large manufacturing center, is that the products of Cleveland manufacturers are confined almost entirely to machines for highly specialized industries. Comparatively few of the more standard forms of tools, such as engine lathes, milling machines, planers, shapers and drill presses, are manufactured in Cleveland. Cleveland is recognized the world over as a leader in the production of automatic machines such as those employed for making screws and for tapping nuts. Turret lathes, multi-spindle drills and forging machinery also form an important part of the city's annual production. In the last decade, several new companies, which are now building milling machines and open-side planers, have located in Cleveland, but the field for the manufacturers of the more conventional types of tools is still relatively undeveloped and offers splendid opportunities to the far-sighted manufacturer.

Will Move to Cleveland

Detroit, Sept. 5.—The Consolidated Car Co., manufacturer of the Abbot-Detroit car, is to move to Cleveland, according to an announcement by the firm. The removal will take place in January.

The company has purchased six acres in East Cleveland in the vicinity of the Chandler, Jordan and General Electric plants, and at a recent meeting the stock was advanced from $500,000 to $1,500,000. The name of the company has also been changed from the Consolidated Car Co. to the Abbot Corporation.

The Largest Single Shipment of Automobile Trucks Ever Made. Six Hundred and Ninety-five

Cleveland, Birthplace of the American

THE day of the hiccoughing, asthmatic one-lunger is past. Its place has been usurped by the sweet-running four, six, eight and 12-cylinder automobile, whose presence no longer is the subject of comment in little half-forgotten hamlets off the beaten path. On the highways and the by-ways, over velvet macadam, through quagmire and corduroy, from the snow-swept peaks of the Rockies to the everglades of the south, the automobile has come into its own.

Few commodities have risen as rapidly in popular favor as the automobile. The wealth which has poured into the coffers of the successful car builder has surpassed the fondest dreams of the pioneers of the industry. The number of manufacturers who are daily hurrying into the production of motor cars, lured by the stories of the fabulous returns and blind to the risks and disappointments always encountered, brings to mind the early days of '49 and the stampede to the gold fields.

Cleveland Early in the Field

Cleveland has taken her share of the fruits in passing. Other localities may have surpassed the Forest City in the numerical production of automobiles, in the value of the cars turned out or in the number of individual firms located within their corporate limits. But the first glory comes to Cleveland, for there, on March 24, 1898, the first American-built gasoline car reached the American market. Alexander Winton, pioneer in many things, sold his first machine to Robert Allison, mechanical engineer, Port Carbon, Pa. It was a proud day for the builder, for the purchaser, and for the city it was the nucleus of a $100,000,000 industry.

By rapid stages of development the automobile originally produced by Winton soon passed into the discard. It became evident very early in the manufacture of a gasoline-powered vehicle that multiple cylinders were more satisfactory. As a matter of fact multiple-cylinder construction preceded the single cylinder car by two years and was built by Winton as an experiment. In this, as in all other lines of industry, there were many who fell by the wayside. When it became evident that a self-propelled vehicle such as was then making a success on the market, was a possibility with a tremendous future, many manufacturers engaged in totally different lines took up the construction of motor cars. Few concerns weathered the storms of criticism or withstood the burdens of failure and disappointment. The early formation of such companies as the Peerless, Stearns and White in the gasoline field, and the Baker and Rauch & Lang in electric vehicle manufacture, served to buoy the industry when times were hardest and the future darkest. Their success has done much toward making Cleveland a powerful factor in the automobile building world. The early prestige of Cleveland as a motor car building center has attracted many other successful automobile manufacturers. In this connection it is worthy of note that the production of automobile accessories in Cleveland is an important industry. There are several drop forging plants, and while concerns of this kind are not limited entirely to the production of automobile parts, a large part of their business comes from the automobile industry. Lamp makers, spring makers and several body building companies find that a substantial part of their yearly revenues come from the automobile manufacturer.

Early and Present Plants

It is interesting to compare briefly a few statistics of the earlier Cleveland companies with their present facilities. The first Winton car, as shown in an accompanying illustration, was a single cylinder machine. It was built in an insignificant shop and sold by a one-man sales organization. During 1898 Winton built 21 cars, all on the same pattern. The present plant of the Winton company occupies about 13 acres at Madison and West 106th street; employs 1,300 men and has a yearly capacity of 2,000 cars. Plans are now being prepared to increase this output to 2,500 cars for 1916. The first Stearns car was likewise a single cylinder affair and was built by two men in a little ramshackle shop, 20 x 40 feet. The capacity of this "plant" was one car a year. The F. B. Stearns Co. now manufactures a four and eight-cylinder Knight-type motor, employs 1,200 men and has increased the capacity of its plant 1000 per cent. This company is turning out 3,000 cars a year.

Large Truck Builder

The Peerless Motor Car Co. entered the manufacture of motor-driven vehicles in a 'round about fashion. In 1900 this concern started to manufacture automobile parts, having been previously engaged in the production of bicycles. In 1901 the Peerless company secured the American rights to the DeDion-Bouton, a French car, and a few machines of this type were turned out in a very small plant on Lisbon avenue. In 1902 the company decided to produce its own car and in that year the Peerless was brought out. The company was reorganized as the Peerless Motor Car Co. and has done business under that name since. Its present output consists of heavy duty trucks and pleasure cars. A number of these commercial cars have been purchased by foreign governments for war service and the United States has made use of several machines of the heavy-duty type for border patrol in Mexico. The pleasure car is built with one type of motor, eight cylinders. The Peerless company builds approximately 5,000 cars a year including trucks. The plant occupies over 20 acres and employs 2,000 men.

The history of the White Co. is particularly interesting. Originally a manufacturer of sewing machines, the late Thomas H. White undertook the production of a steam-driven automobile. This car was brought out in 1900 and its performance was remarkable. The manufacture of this type of vehicle was maintained until 1908 when the company made a radical change from steam to gasoline, and offered the White company's first internal combustion motor. The White Co. manufactures a pleasure

Cleveland-Made Machines Being Lightered Down New York Bay Enroute to War-Riven Europe

Automobile, Ranks High in Car Production

BY RALPH H. JONES

car as well as a commercial truck, and an unusually large number of the latter have been shipped abroad. The ground area of the White plant is in excess of 600,000 square feet and further extensions are contemplated. Late in 1915 a combination of interests was effected whereby the White Motor Co. was organized to manufacture White cars, the White Co. handling the sales. While no authoritative figures are available, the production of White pleasure cars and trucks is believed to be about 10,000 machines a year. The company employs approximately 3,500 men.

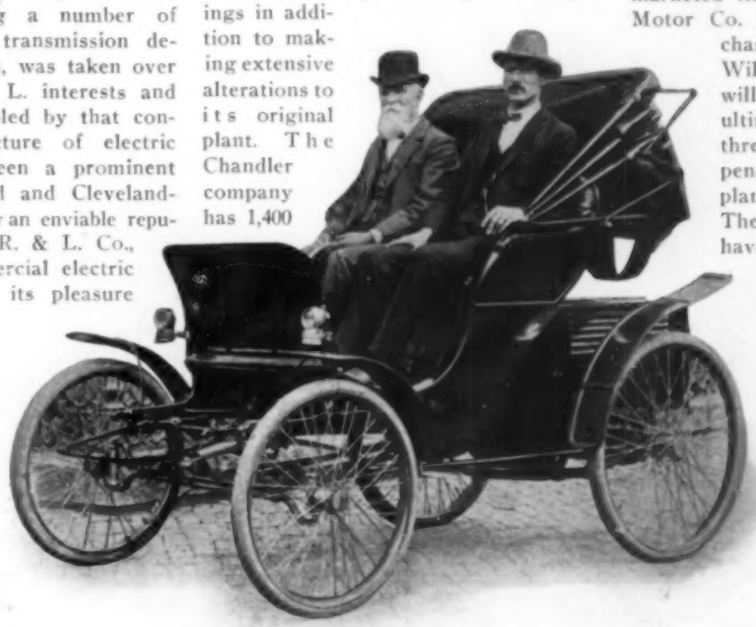
Prestige of Cleveland Electrics

The Baker, R. & L. Co., builder of Rauch & Lang electrics, as well as the Owen magnetic car, operated as two competing concerns, Baker and Rauch & Lang, for a number of years. Through a consolidation which was effected June 1, 1915, the production of Baker electrics was discontinued and the Rauch & Lang cars built exclusively. In January, 1916, the Owen magnetic, embodying a number of unusual features in transmission design and construction, was taken over by the Baker, R. & L. interests and is now being assembled by that concern. The manufacture of electric vehicles has long been a prominent industry in Cleveland and Cleveland-made electric cars enjoy an enviable reputation. The Baker, R. & L. Co., which built a commercial electric in conjunction with its pleasure car industry sold that branch of its business to the General Vehicle Co. The production of the Owen magnetic, which is built on a pleasure car chassis only, will be about 1,000 cars during 1916. It has been conservatively estimated that the Baker company will build 1,000 electrics this year. The plants of the Baker, R. & L. Co., comprising the Rauch & Lang Works on West Twenty-fifth street and the Baker plant on West Eighty-first street, cover about 280,000 square feet.

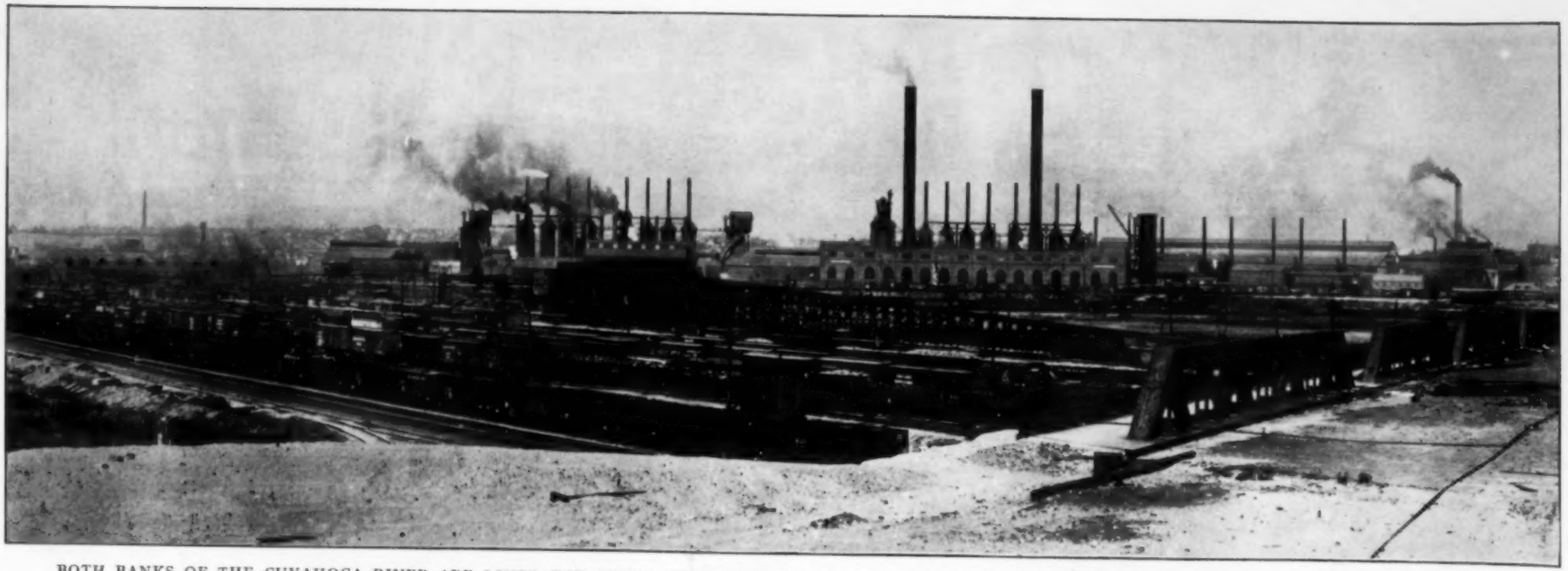
Late Arrivals in Cleveland

Returning to the gasoline cars which are built in Cleveland, we meet the comparative newcomers, and the strangers. In February, 1913, the Chandler Motor Car Co. was formed. The organizers came well recommended and their first car, a lightweight six, embodied several new and unusual features. The success of this company has been marked and the growth of the company's plant has likewise been worthy of note. In the short time this concern has been located in Cleveland, it has increased its capacity from 2,000 to 20,000 cars a year and employs 14 times as many men as it did three years ago. The company has erected four new buildings in addition to making extensive alterations to its original plant. The Chandler company has 1,400 men on its payroll at the present time. The H. A. Lozier Co. started operations in Cleveland in January, 1916. This car is built with a 12-cylinder motor. The H. A. Lozier Co. will assemble about 1,000 cars this year.

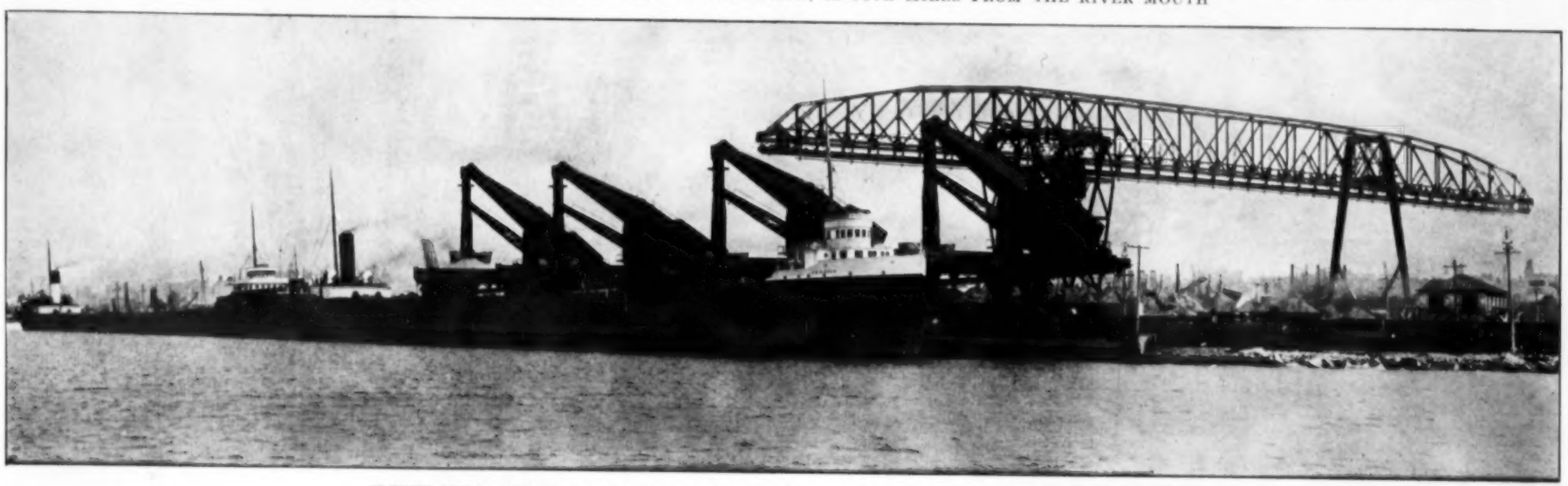
Among the strangers we find one well-known builder, and two whose cars are yet to be produced. The Grant Motor Co., Findlay, O., is erecting a $400,000 plant in Cleveland and expects to start operations about the middle of September. This company will have an initial output of 70 cars a day. As the plant gradually reaches its capacity, 150 cars a day will be produced. The RiChard Auto Mfg. Co. has erected a plant in Cleveland and states that the actual production of cars will be commenced at an early date. The capacity of this plant, it is said, will be 600 cars a year. The Harding Motor Co. plans to build a 12-cylinder car and by the time this article appears it is likely that this concern will have marketed its product. The Ben Hur Motor Co. is reported to have purchased a 9-acre tract in Willoughby, O., where it will erect a plant which will ultimately be comprised of three units. The total expenditure for the complete plant is estimated at $300,000. The plans of this company have not yet been made public, but it is believed that the car which will be marketed will be assembled. Several plants are being negotiated for by the Ben Hur Motor Co., in which the parts will be built and then shipped to Willoughby for assembling. Definite announcement, it is expected, will be made shortly of the plans of this company — Cleveland's newest.



ROBERT ALLISON IN THE FIRST WINTON AUTOMOBILE



BOTH BANKS OF THE CUYAHOGA RIVER ARE LINED FOR MILES WITH MANUFACTURING PLANTS. THE BLAST FURNACE AND STEEL PLANT OF CORRIGAN, McKINNEY & CO., SHOWN IN THIS ILLUSTRATION, IS FIVE MILES FROM THE RIVER MOUTH



CLEVELAND'S NEWEST ORE UNLOADING PLANT IS ONE OF THE LARGEST IN THE WORLD

CLEVELAND
Noted for its Foundries

THE history of the foundry industry in Cleveland may be traced back nearly to the time when the city itself was founded by the scant handful of pioneers who endured untold hardships during their journey from the east before they reached the place of their choice where the crooked Cuyahoga empties its muddy waters into Lake Erie. Almost before their crude log cabins were completed, the settlers turned their efforts to ship building to which industry Cleveland foundries owe their origin. During the first few years of its existence, Cleveland enjoyed a normal growth but could boast of nothing unusual either commercially or industrially. The advent of the railroads and the extension of the paths of commerce on the Great Lakes created possibilities for Cleveland that were far beyond the imagination of early settlers who waited patiently while all of their raw and finished products were hauled in crude wagons or towed in canal boats from the commercial centers of the Atlantic seaboard and the manufacturing districts east of the Alleghenies.

But when, in the middle of the last century, the railroads were established between Cleveland and the coal fields and the boats began to enter the port loaded with iron ore and other products from the wonderful deposits of the Superior region, Cleveland's development started and has continued without pause. Within a few years after the first locomotive reached the city, Cleveland was recognized as one of the leading railroad and shipping centers of the middle west. Blast furnaces were built to smelt the iron ore and industry after industry was started to convert the raw materials into refined products. Thus, in a period of slightly more than 100 years, Cleveland has developed into a city of over 700,000 people, taking high rank among American cities for the diversity of its industries and the quality of its manufactured products.

Cleveland, sixth in the United States in population, ranks third in the num-

INTERIOR OF PROMINENT CLEVELAND CONTINUOUS FOUNDRY

ber of foundries within the city limits. The following authoritative figures give the number of foundries in the first four cities of United States but do not include general offices of foundries not located within the city limits: Chicago, 170; New York, 115; Cleveland, 112, and Philadelphia, 106.

A normal and healthy expansion of an industry is gratifying but can not always be relied upon as a criterion of progress if numbers alone are considered. Cleveland foundrymen are reputed to be quick to adopt improvements and innovations in shop methods and the city enjoys the reputation of having some of the best equipped foundries in the country. It also is a center for the manufacture of molding machines and other foundry equipment.

Leads in Light Gray Iron Castings

The production of light gray iron castings is by far the most important component of Cleveland's foundry industry. In this Cleveland is said to lead the world. The greatest part of the iron melted for light gray iron castings is used for automobile cylinders. Cleveland foundries cast approximately 500,000 complete sets of automobile cylinders every year. The three leading manufacturers of these castings melt, on an average 300 to 350 tons of iron a day, producing nearly 1,500 sets of cylinders. The automobile industry not only calls upon Cleveland for cylinder castings, but also for a large portion of the various brass and aluminum castings which are so essential in the modern motor car. One of the largest aluminum foundries in the United States is located in Cleveland, and, although this metal has been generally used but 14 years, the production of aluminum castings is one of the most important phases of Cleveland's foundry industry. During recent years an enormous demand for aluminum castings for vacuum cleaners has developed while the advent of aluminum pistons promises to make still further demands upon Cleveland's aluminum foundries. Also this city is noted throughout the United States as a manufacturing center of brass and bronze plumbing fixtures.

Although Cleveland may not be classed as a foundry center of the first importance in the production of large iron and steel castings, there are several foundries in the city which produce exceptionally heavy castings in large quantities. One of these is operated by the American Ship Building Co. and is capable of turning out castings weighing up to 20 tons. The greatest proportion of the work at this foundry is confined to the production of castings used on vessels, such as bed plates, propellers, hubs and other parts made of semi-steel and iron. Several firms in Cleveland specialize in making large steel castings for rolling mills and similar purposes. One foundry has a wide reputation for the production of castings used in sugar-mill machinery.

Carriers Aid Development

Excellent transportation facilities have been responsible in a measure for the industrial development of Cleveland. This city is served by 10 steam railroads, a number of interurban lines and by 45 steamship companies conducting a strictly freight business. These facilities not only aid the foundry industry by providing a cheap and rapid means of shipping the finished products but serve to increase the volume of foundry business in Cleveland in that numerous castings are demanded for the construction and maintenance of railroad and vessel equipment. Therefore, in addition to the ship building shops, several railroad foundries are located in Cleveland. Two foundries directly interested in this phase of the work produce thousands of car wheels annually.

Home of Industry

(*Concluded from page* 63.)

Marcus Alonzo Hanna. While the political career of Senator Hanna, who died in Washington, Feb. 15, 1904, was one of the most remarkable in the history of the country, the story of the development and progress of the great firm of M. A. Hanna & Co., of which he had been the senior member for nearly 30 years, is not less interesting. It is a narration of modest beginning, steady progress and adaptation to new conditions such as have seldom been witnessed in the business world. While the properties and business of the firm have undergone many changes, each change has brought greater strength, until today it is a more important factor in the commercial and industrial affairs of the central west and of the Great Lakes than ever before. Mr. Hanna's business career began in 1857 when he became an employe of the wholesale grocery house of Hanna, Garretson & Co., of which his father was the senior member. In 1867, when the pioneer iron and coal firm of Rhodes & Card retired from business, Mr. Hanna became the senior member of the succeeding firm, Rhodes & Co., dealers in coal and iron. The firm was dissolved in 1885 and was succeeded by that of M. A. Hanna & Co., the members then being M. A. Hanna, L. C. Hanna and A. C. Saunders. In 1872, Mr. Hanna with other capitalists organized the Cleveland Transportation Co., which owned and operated a line of steamers in the iron ore trade. He was for several years general manager as well as a director of the company, and throughout his active business career he was a powerful factor in the lake transportation business. During the last 10 years of his life, Mr. Hanna devoted his attention almost exclusively to politics. His brother, L. C. Hanna, paid close attention to the affairs of the firm until failing health compelled him to take a rest. He retired from the firm in 1904, but again became a member of it in 1915. For many years he has been regarded as one of the ablest men in Cleveland connected with the iron business. He also has been a strong factor in the Republic Iron & Steel Co. and other concerns. L. C. Hanna belongs to that class of high grade men which has included S. W. Croxton, S. T. Wellman and many others of great force, who have built on the foundations which were wisely laid by the older men.

One of the strongest features in the iron and steel business of Cleveland is the selling of pig iron and finished materials by men of marked ability who are conducting their part of the business in a highly creditable manner. While competition is keen, it is noted for the good feeling which prevails. Leading Cleveland salesmen have discovered how to conduct business on a high plane.

Looking to the future, one cannot doubt that Cleveland will hold its place as a leading iron and steel manufacturing city. During the past few years, the building of new plants and additions by the Otis Steel Co. and the Upson Nut Co., the erection of new blast furnaces, a steel plant and finishing mills by Corrigan, McKinney & Co., very large additions by the American Steel & Wire Co., and countless additions and improvements by other concerns, give some indication of the progress Cleveland is making in the manufacture of iron and steel. The city was fortunate in the great personal strength of the founders of the industry. It has been fully as fortunate in the men who have contributed to the progress of all the manufacturing industries during the past 50 years, and there is abundant evidence that the younger men now coming into prominence will do their work fully as well as their predecessors.

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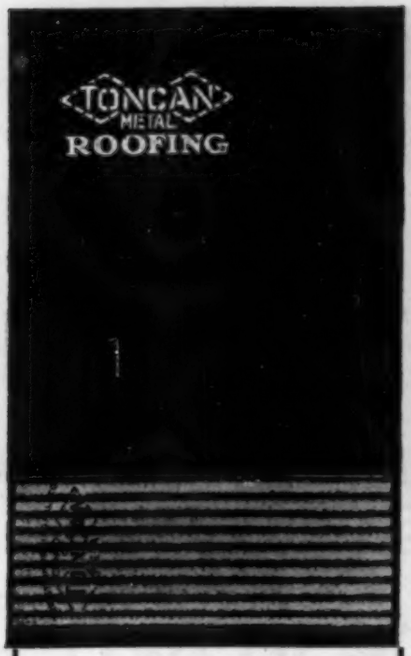

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Painted or Galvanized

WHERE durability, strength, fire-resistance, appearance and economy are necessary, Corrugated Toncan Metal Roofing will fulfill the requirements in every respect.

It cannot burn, break, crumble, melt or warp, and it is corrosion-resisting. It is very easy and economical to apply. Only a light superstructure is needed. And its cost is very moderate.

Toncan Metal Corrugated Roofing is used very extensively for factories, mills, warehouses, railroad buildings and other similar structures. The Corrugated Sheets also make a splendid siding.

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It makes a weather-proof, fire-proof and durable roof.

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Each roll will lay 100 square feet on the building.

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The appearance of Toncan Metal Standing Seam Roofing conforms admirably with many of the modern styles of architecture.

It is corrosion-resisting, fireproof, weather-proof, non-breakable, economical to apply and moderate in cost.

It is made in lengths from 5 to 12 feet inclusive, and in 20, 22, 24, 26, 27 and 28 gauges. Covering width of each sheet is 24 inches.

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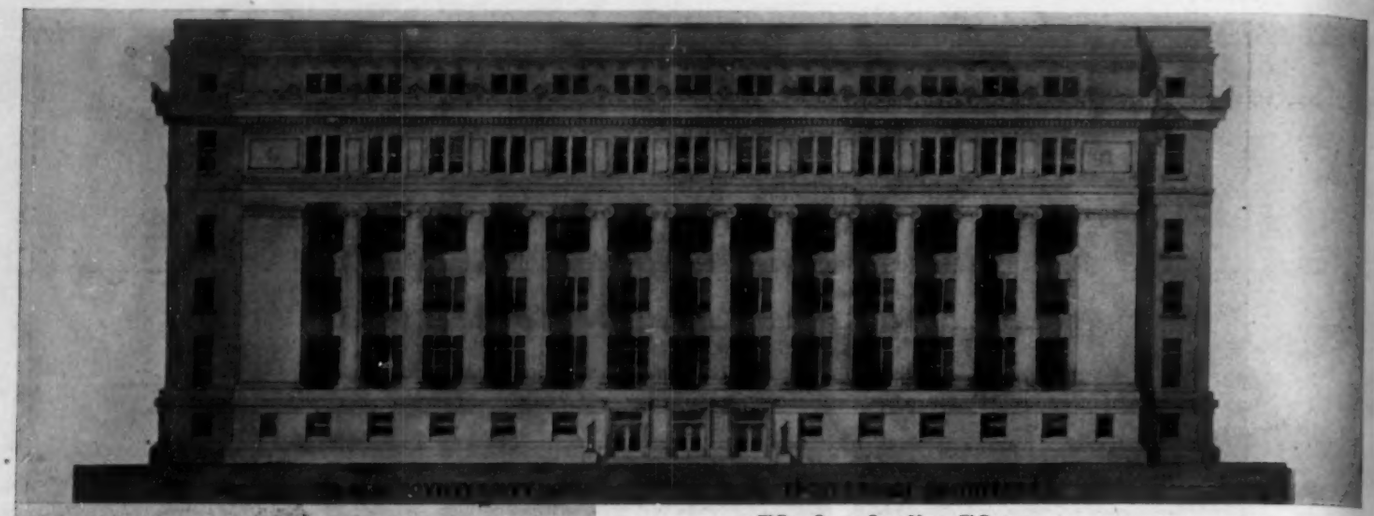

El Paso County Court House, El Paso.
The Hamilton Co., Heating Contractors, Dallas, Texas.
J. A. Brennan Plumbing Contractors, El Paso, Texas.
"Youngstown" Pipe used. Trost & Trost, Architects.

Wills Building, El Paso, Texas. Elliott & Barry Eng. Co., St. Louis, Heating Contractors. Richey & Morgan H. & P. Co., Plumbing Contractors, El Paso. "Youngstown" Pipe used, Trost & Trost, Architects.

Youngstown Pipe

In these pages have been shown from month to month illustrations indicating the predominance of "YOUNGSTOWN" pipe in the heating and plumbing systems of the most notable buildings in Washington, Philadelphia, New York, Chicago, Denver and San Francisco. It was placed in the buildings shown by many architects and engineers who are recognized as leaders in their profession.

Herewith are illustrated, not one, but nine splendid buildings designed by a single firm of architects and erected in a single city—in all of which "YOUNGSTOWN" Pipe was used exclusively. The architects are Trost & Trost, and the city is El Paso, the metropolis of the great Southwest.

Here is conclusive evidence of the QUALITY of "YOUNGSTOWN" Pipe. Would any architect stake his reputation repeatedly on the installation of any material if he were not certain that no better could be obtained?

The Youngstown Sheet

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First National Bank Bldg., El Paso.
Elliott & Barry Eng. Co., Heating Contractors. C. F. Clark & Co., Plumbing Contractors. "Youngstown" Pipe used. Trost & Trost, Architects.

Popular Dry Goods Building, El Paso, Texas.
Jas. E. Brennan, Plumbing Contractor, Trost & Trost, Architects.

White House-Department
Elliott & Barry Eng. Co.
Palmer, El Paso, Plumbing
Pipe used. Trost & Trost.

El Paso High School, El Paso.
Elliott & Barry Engineering Co., Heating Contractors.
L. P. McChesney, Plumbing Contractor, El Paso.
"Youngstown" Pipe used. Trost & Trost, Architects.

in El Paso....

Would any firm of architects insist on the installation of "YOUNGSTOWN" Pipe in building after building, unless the QUALITY of that pipe has been tested and demonstrated, its superiority proven beyond all question?

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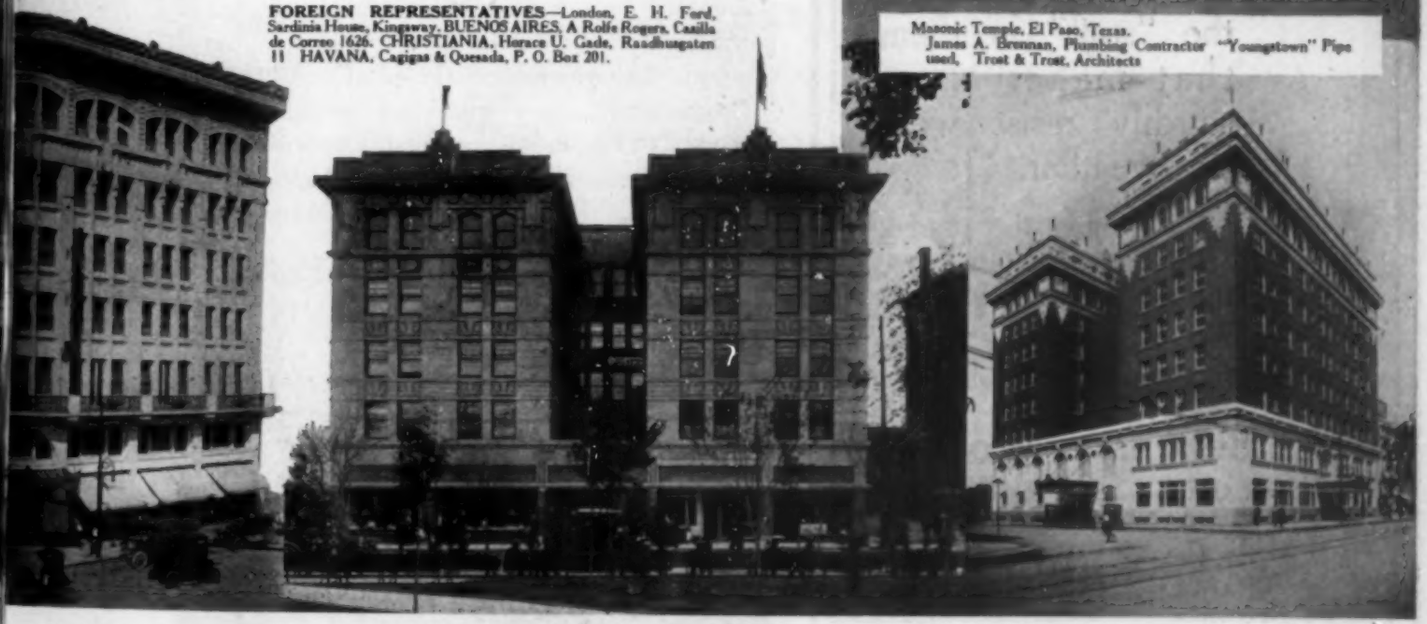
Masonic Temple, El Paso, Texas.
James A. Brennan, Plumbing Contractor "Youngstown" Pipe used, Trost & Trost, Architects



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Heating Contractors. A. B.
Contractors, "Youngstown"
Architects.

Roberts-Banner Building, El Paso.
Elliott & Barry Eng. Co., Heating Contractors,
Richey & Morgan H. & P. Co., Plumbing Contractors
"Youngstown" Pipe used. Trost & Trost, Architects.

Paso Del Norte Hotel, El Paso, Texas.
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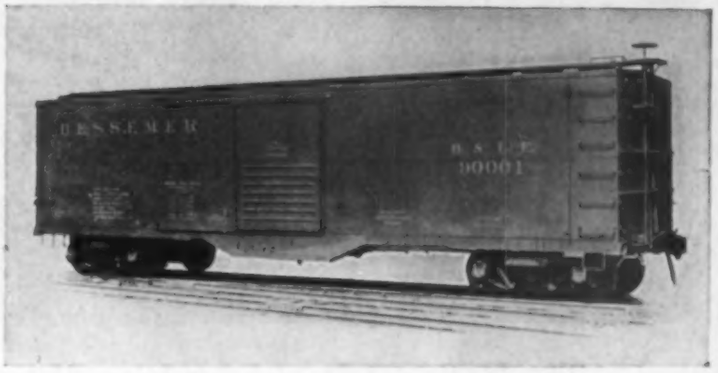

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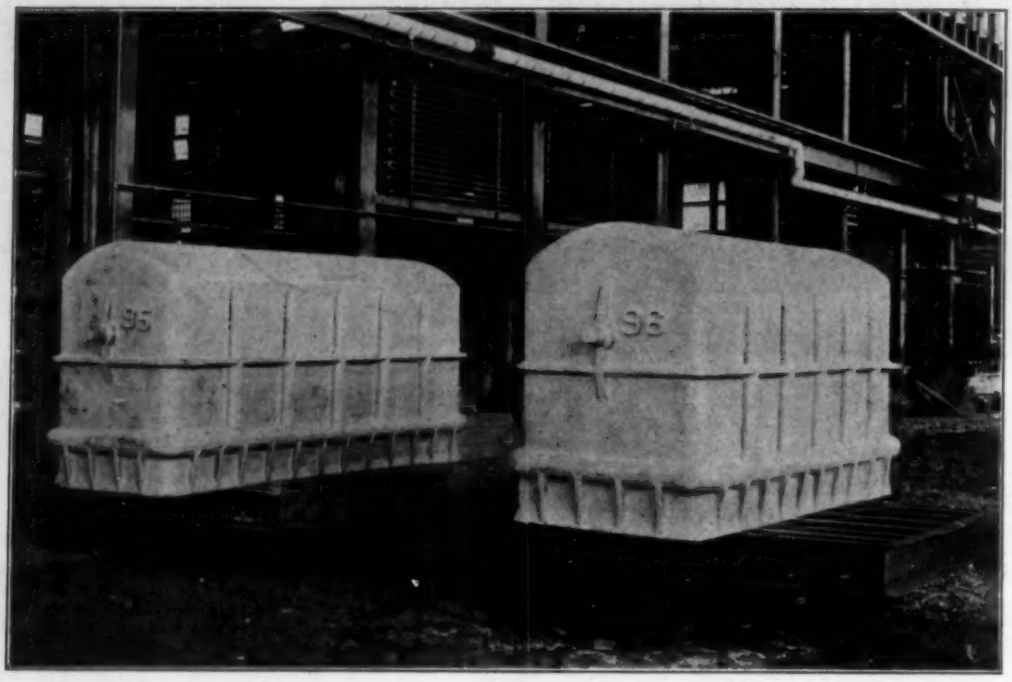

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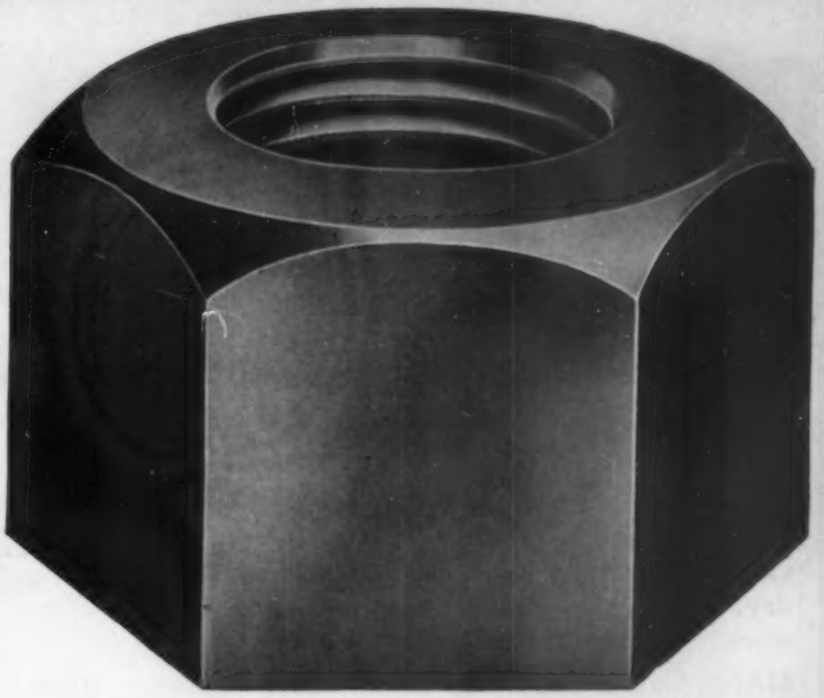

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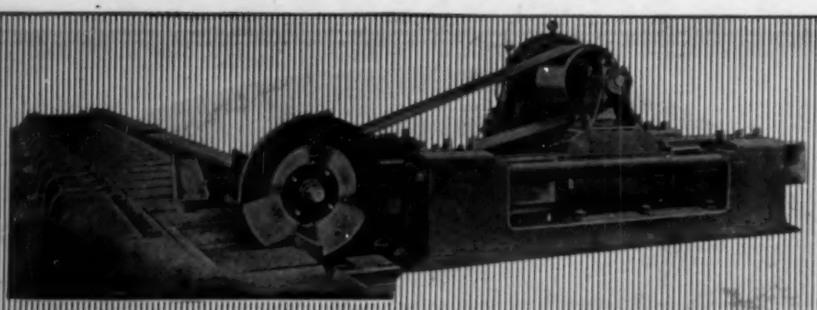

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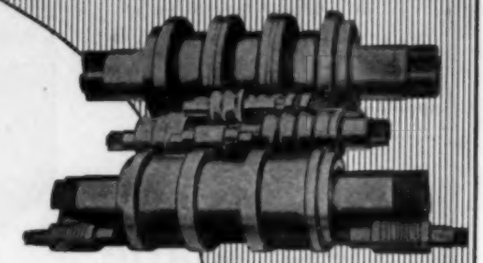

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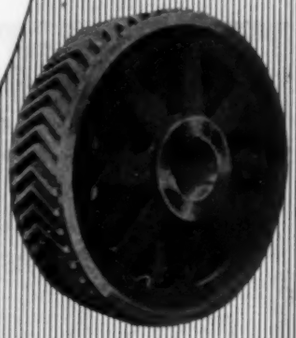

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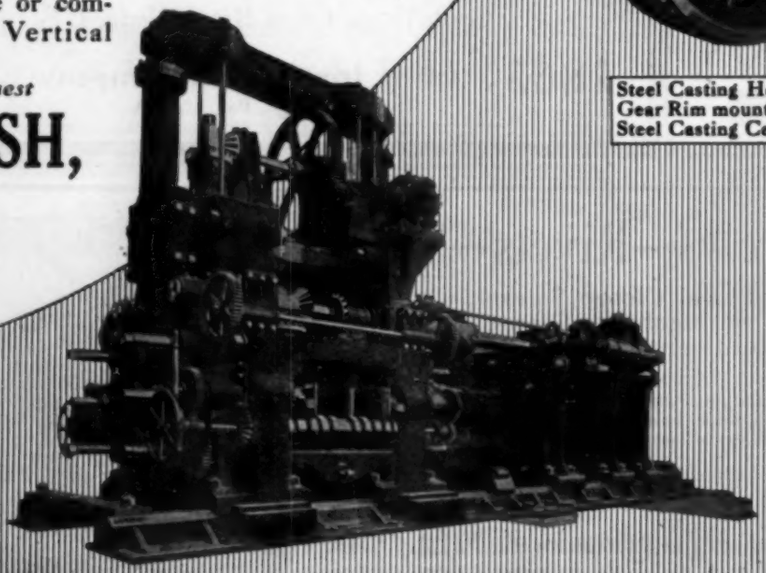

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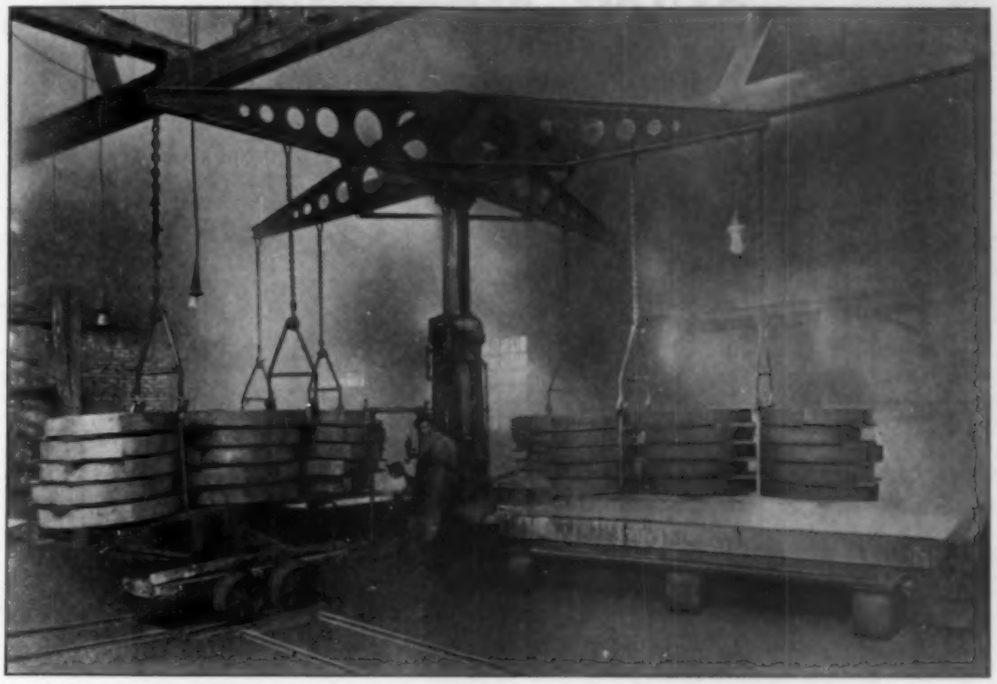

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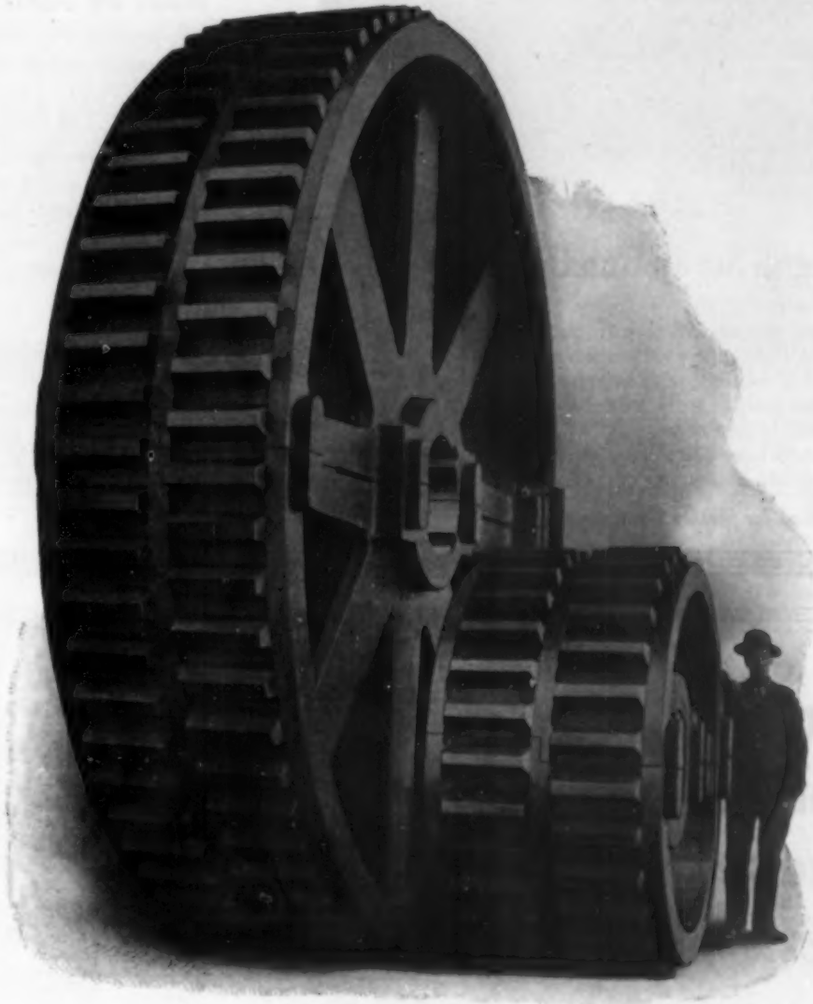

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"Largest Roll Makers in the World, Makers of the Largest Rolls"

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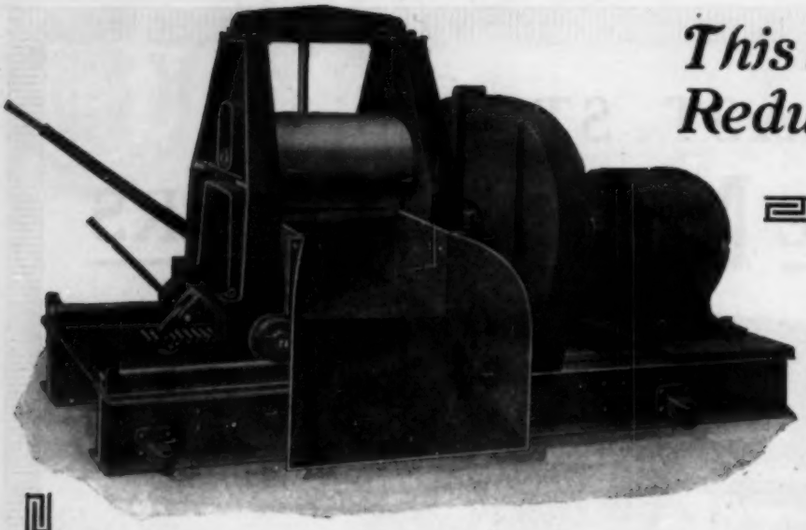


This Machine will Reduce Your Costs!

Its *ease of operation, speed* and *strength* will enable you to turn out more work with less effort and expense than will any other method. The *Spindle* is stationary. The *Carriage* and *Feed Trough* are movable. The entire machine is as compact, convenient and durable as our 45 years of expert knowledge and tireless experimenting can make it.

The Vaughn Scrap Bundlers

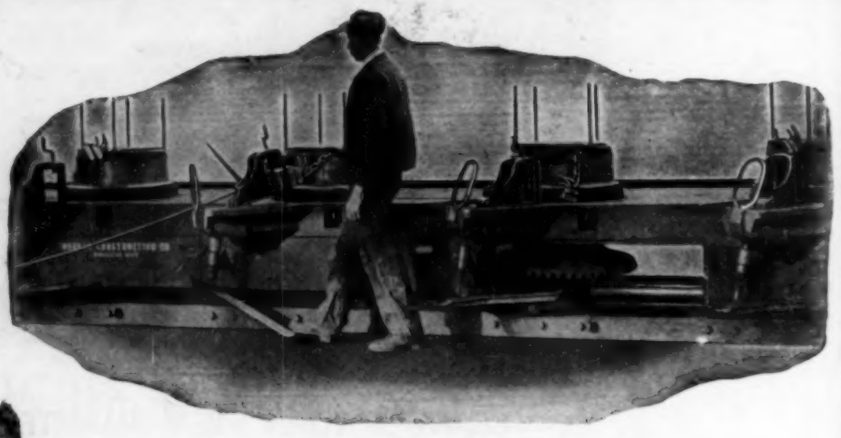
for wire and wire-rod scrap, are made in two sizes. They are guaranteed to turn out firm, regular bundles, 16x18, and 18x24 inches in size. The "Vaughn" is entirely self-contained on a substantial base plate. It is built for either motor connection or belt drive.

We manufacture a complete line of the highest grade Wire Mill Machinery.

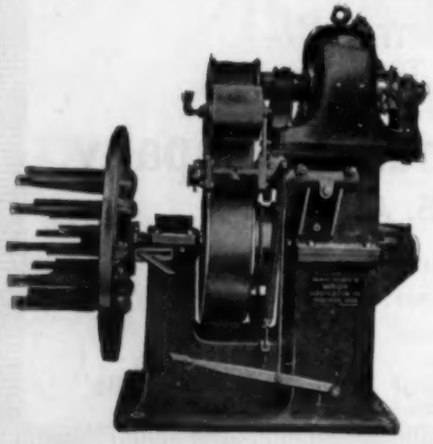
Write today for further information.

THE TURNER-VAUGHN AND TAYLOR CO.
ENGINEERS AND MANUFACTURERS
CUYAHOGA FALLS OHIO. U.S.A.

A line of big Money Savers



Rod Frame equipped with Carroll Friction Blocks



MILL EQUIPMENT

The above illustration shows one of our heavy rod frames equipped with ***Friction Blocks.*** Enclosed within each block is a coil clutch. We equip each block with an automatic safety stop.

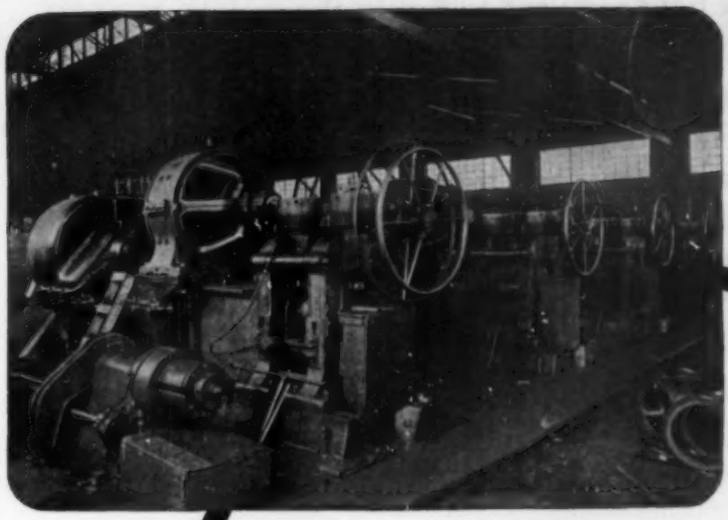
No draw-out mechanism is required, and the machine is characterized by high efficiency and low maintenance costs.

We also design and build MILLS for ***Billets, Bars, Thin Flats*** and ***Rods.*** Also Heating Furnaces, Cooling Beds, Dyblie Gas and Air Reversing Valves. ***Write us for full details.***

MORGAN CONSTRUCTION CO.
WORCESTER, MASS.

Westinghouse

Cold-Strip Mill Motors and Control

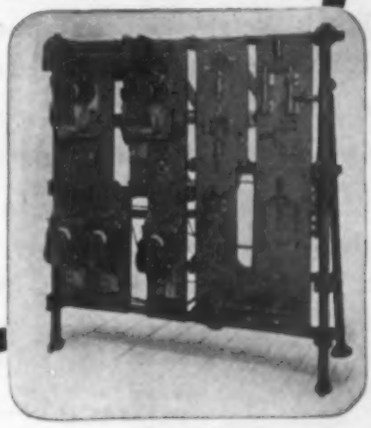


Tandem operation with individual motor-drive is the latest development in cold rolling.

The motors are started separately, but are arranged to stop together, preventing undue strains on the metal or the drives.

Westinghouse Equipments for cold rolling mills embody the most recent and practical features of design.

A card to our nearest office will bring complete information.



W
WESTINGHOUSE ELECTRIC

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You try to save labor in your shop— Why not save it in your office, too?

With "Elliott's Weights of Steel", you can cut in half the amount of time and work now required to figure the weight of your orders for rolled steel.

Just reason it out for yourself. See how long it takes you, for instance, to figure the weight of a piece of steel 38 feet 7¼ inches long, weighing 47 pounds per foot, and then think what a saving of time and trouble it would be to turn to a convenient table, and simply read off the answer.

"Elliott's Weights of Steel" will enable you to do just that. It is a book of tables that enables the user to tell instantly and accurately the weight of any piece of rolled steel from 1/16 inch to 60 feet in length. Absolutely no calculation is necessary, except a bit of simple addition in some cases.

Try it in your own office at our expense

We will send you the book without expense or obligation on your part, so that you can see for yourself before you buy it, how much it saves you. Keep it for a week, use it in your work and if your own experience doesn't show you that "Elliott's Weights of Steel" would earn many, many times its cost, simply return it at our expense, and your decision will be accepted without murmur or question.

We want you to keep it only if it proves such a time and money saver that you wouldn't willingly part with it.

Here's an opportunity to increase your profits with the element of chance absolutely eliminated. Simply tell us to send on approval "Elliott's Weights of Steel", as advertised in THE IRON TRADE REVIEW.

Price — $20.00 postpaid.

THE IRON TRADE REVIEW

(BOOK DEPARTMENT)

PENTON BUILDING CLEVELAND, OHIO

(231)

ADAMITE

COUPLING BOXES FOR ROLLING MILLS

Modern Rolling Mill conditions subject the coupling boxes to tremendous shocks and strains.

Wherever coupling boxes break down, it proves very serious and costly—therefore, progressive Rolling Mill owners are insuring themselves against such possibilities by having all coupling boxes made of *"Adamite"*.

"Adamite", on account of its extreme toughness and ability to withstand such severe treatment, has been proved to be thoroughly dependable.

"Adamite" is being used with great success for such purposes.

Ask Us

PITTSBURGH IRON & STEEL FOUNDRIES CO.

MIDLAND, PA. PITTSBURGH, PA.

CONSIDER THE BRIQUETTE

It Means Saving and Revenue

To Coal Operators

To Foundries

To Blast Furnace Operators

FUEL BRIQUETTES—DUTCH OIL PROCESS The only real success in fuel briquetting

The only anthracite briquettes now successfully marketed are made by this process.

SOFT COAL Thousands of tons made by this process are now marketed at a good profit.

Also applicable to lignite coke "breeze" and other fuels

METAL BRIQUETTES (RONAY PROCESS)

Behave like heavy scrap in melting.

Saving thousands of dollars for our customers.

Which of these applies to YOU?

Converts a nuisance into a high-grade furnace feed.

FLUE DUST BRIQUETTES (SCHUMACHER PROCESS)

A real economy in blast furnace practice.

Also processes for briquetting of zinc dust, fine ores, etc.

Applicable to all small metal scrap, chips and turnings; Brass, Copper, Aluminum, Iron, Steel, etc.

GENERAL BRIQUETTING COMPANY

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Metallurgical Engineers

The cleanest and best method for recovering flue dust

If you have "Fines" or other small products you have a Briquetting problem. Let us figure it.

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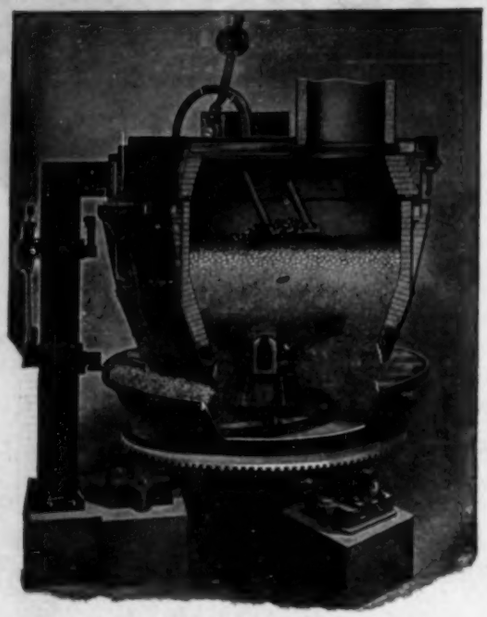


Have you seen those remarkable continuous records made by the

Morgan Producer-Gas Machine?

Nothing like them before. They place this machine in a class entirely beyond the reach of the ordinary mechanical gas producer.

Capacity, Gas Quality, Freedom from Labor and Economy of Installation are all increased to a surprising degree.

See new Catalogue by the

Morgan Construction Company

Worcester, Mass.

QUICK SERVICE

For Switch Yards and Steel Mills

No. 5625 STORAGE BATTERY LOCO-MOTIVE

Designed Especially for Moving Rolling Stock

Made in several sizes to suit requirements.

If you own an *"Atlas" Storage Battery Locomotive* you won't have to wait until the railroad gets ready to do your switching. You can switch just *what* you wish, just *when* you wish. This will mean a great deal of time and convenience to you.

Any employe of ordinary intelligence can run this locomotive. All parts are easily accessible for oiling, adjustment and repair.

If you are interested in saving money, send for our catalog and read about our entire line of Storage Battery Locomotive Cranes and Cars.

The Atlas Car & Manufacturing Co.

1200 Marquette Rd. Dept. E. Cleveland, Ohio

WILLIAMS CRUSHERS

ADAPTABILITY

To correct a wrong impression which some of our friends may have in regard to the uses to which the Williams Crushers may be put we wish to advise that in the coal field, they are not only suitable for crushing coal for the coke ovens, but are also used quite extensively in the preparation of coal for stokers and chain grates, as well as in the anthracite region for the reduction of Mine debris, preliminary to flushing back into the worked out pits of the Mines. In addition to this they are excellent crushers for low grade Iron Ore. Briefly they are suitable for crushing Coal for

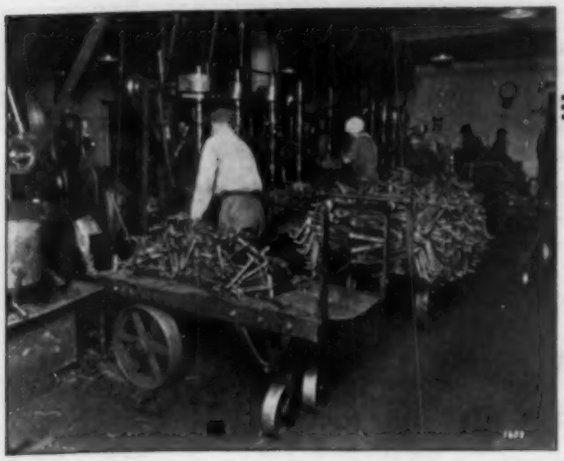
COKE OVENS
STOKERS
CHAIN GRATES
MINE DEBRIS
IRON ORE

A thorough description with illustrations of the Williams Crushers is found in catalog No. 25. If interested we shall be pleased to send you copy.

The Williams Patent Crusher and Pulverizer Co.

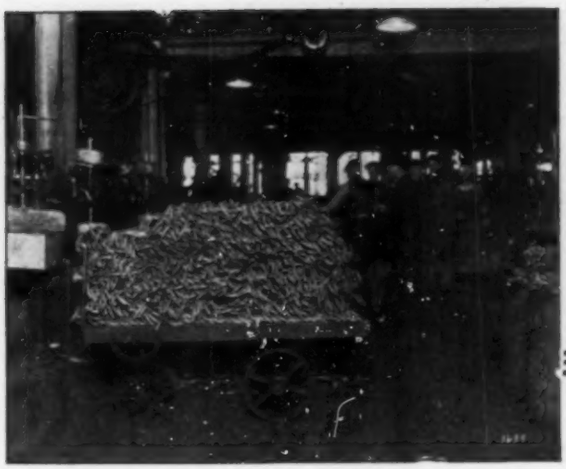
Works: ST. LOUIS

General Sales Dept. Old Colony Bldg., CHICAGO



LAKEWOOD LINE
BUILT TO LAST

LAKEWOOD LINE
BUILT TO LAST



Yes, The Cleveland Hardware Co. uses Lakewood Trucks

And they feel that they are being repaid well for it, too. Long, reliable, economical service seems to make a hit with everybody.

Doesn't it make a hit with you?

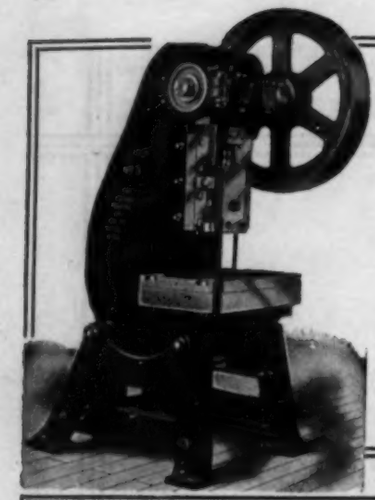
For over 18 years we have been developing and improving Lakewood Steel Industrial Cars and Trucks, until now they are the selection of particular buyers in all parts of the country.

We also specialize the Lakewood Clam Shell Bucket.

WRITE US

THE LAKEWOOD ENGINEERING COMPANY

CLEVELAND, OHIO



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For efficient, economical performance in hard daily service.

The new positive inclining attachment facilitates the use of different dies.

Slide adjusting screw hammer forged from special steel and locked by the most reliable and effective device.

Twenty sizes for nearly every kind of blank cutting, forming perforating, drawing, shaping and combination die work.

THE TOLEDO MACHINE & TOOL CO., Toledo, O.

TALK ABOUT RESULTS!

Read this—

One man put up 150 molds by 3 in the afternoon. **That was treble the production by hand.** The machine that the man worked on was a 10"

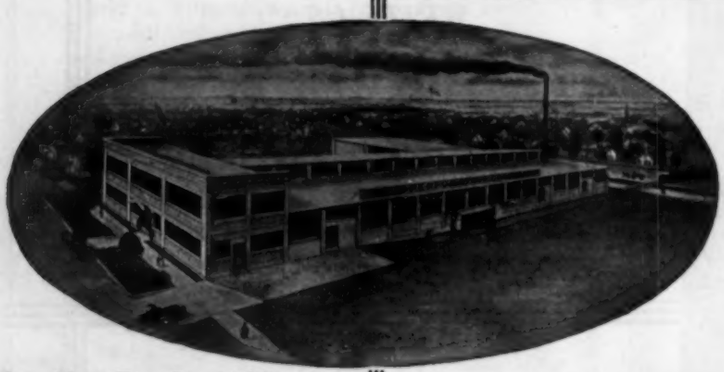
Pridmore

POWER SQUEEZER

The machine was used in connection with a stove shelf match-plate, and the flasks were 10" x 27" inside dimensions. In the same foundry with a flask 11" x 21" one man put up 200 molds a day on a Pridmore Power Squeezer.

Those are records no squeezer can touch. If you have work applicable to a squeezer, you can't get a squeezer that will give you so big an output as the Pridmore. That's strong talk, but the facts back it up. And our special Squeezer Bulletin gives the facts. Write for it.

HENRY E. PRIDMORE **Chicago, Illinois**



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PERFECTLY PERFORATED
SHEET METALS

Our experience covers half a century.
We are perforators of **Aluminum, Brass, Copper, Steel, Tin, Zinc,** etc., for all purposes.
Our Experimental Department is at your service—we invite you to take advantage of it.

May we send you a Metal Sample Plate?

We manufacture Perforated Steel for Machinery Guards and also carry a stock of Perforated Steel.

ERDLE PERFORATING COMPANY
Rochester, N. Y.
New Fire Proof Plant, Childs St. and B., R. & P. Ry.

Entire Pressure is through Solid Metal

BLISS

The graduated eccentric adjustment facilitates setting dies. The slides are long and well gibbed.

Watchmakers whose dies are most delicate use "Stiles Presses" extensively.

The flywheel can be turned backward to release a punch when stuck in the die.

"Stiles" Punching Presses

are built in ten sizes and adapted for punching, stamping, forming and bending operations, in the economical manufacture of cutlery, hardware, locks, auto parts, sewing machines, typewriters, etc. *Write us at once.*

Talk to us about Presses for any and every purpose

E. W. Bliss Co. No. 8 Adams Street Brooklyn, N. Y., U.S.A.

Chicago Office: Peoples Gas Co. Building
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Hydraulic Accumulator, 15" diameter plunger, 15' stroke, 1500 lbs. per square inch pressure.

Presses, Accumulators, Pumps, Rolling Mill Machinery, Jackson Belt Lacing Machines and Blast Furnace Castings.

SAND, STEEL AND CHILLED IRON ROLLS

BIRDSBORO STEEL FOUNDRY & MACHINE CO.
BIRDSBORO, PA.

Aldrich Pumps: Address—Aldrich Pump Co. Allentown, Pa.

Horizontal Punches

Accurate, Durable, Economical

We build a complete line of high grade punches and shears and our catalog illustrates and describes them in detail. Send for a copy. Cleveland means quality and economy.

Our Engineering Department will be glad to help you solve your punching problems. Ask us all the questions you wish. Begin *now*.

The Cleveland Punch & Shear Works Co., Cleveland, O.

PRICE

Don't be fooled by the cheap blades.

Good material costs money.

It isn't so much what you pay as the value you get for your money.

Isn't that right?

SHEAR BLADES

THE L. & I. J. WHITE CO.

15 COLUMBIA ST., -:- BUFFALO, N. Y.

QUALITY

Here's where we shine. We cater to the ones who insist on *the best.* We can suit *you.*

Why not ask our prices? Send for our knife booklet.

FLEXIBILITY

"FLEXIBLE as a Belt" means all it implies when referring to Link-Belt Silent Chain. Yet the toothed gearing action means transmission without slip or loss of power. No high tension—no excessive journal friction—no long centers—all the advantages of the leather belt coupled with 98 per cent guaranteed power transmission efficiency.

LINK-BELT
SILENT CHAIN DRIVES

are an asset in every busy factory today—they increase production by transmitting all the power developed by the motor or engine. You need their many advantages for driving your lineshafting and machines. Investigate and learn how easily and how quickly you can apply Link-Belt Silent Chain to your present equipment.

Flexible as a Belt—Positive as a Gear—More Efficient than Either. Write for our 112-page price list Data Book No. 125.

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Seattle . . 580 1st Ave., South
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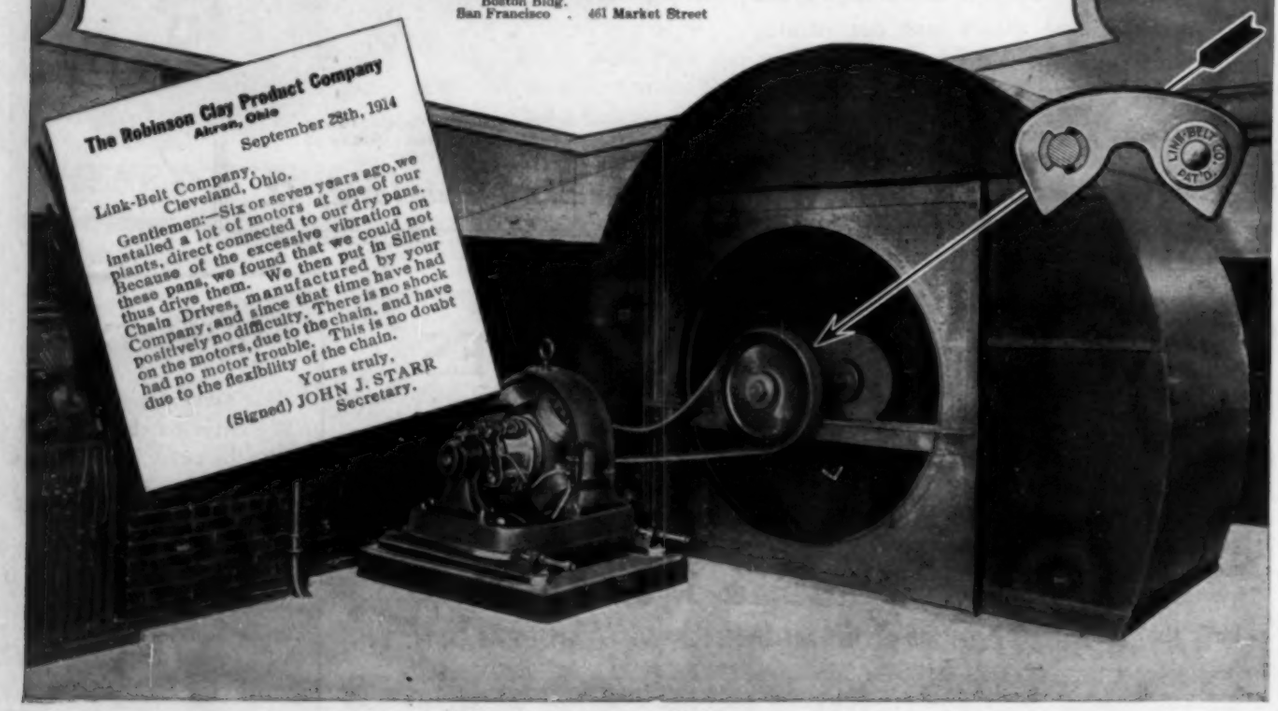
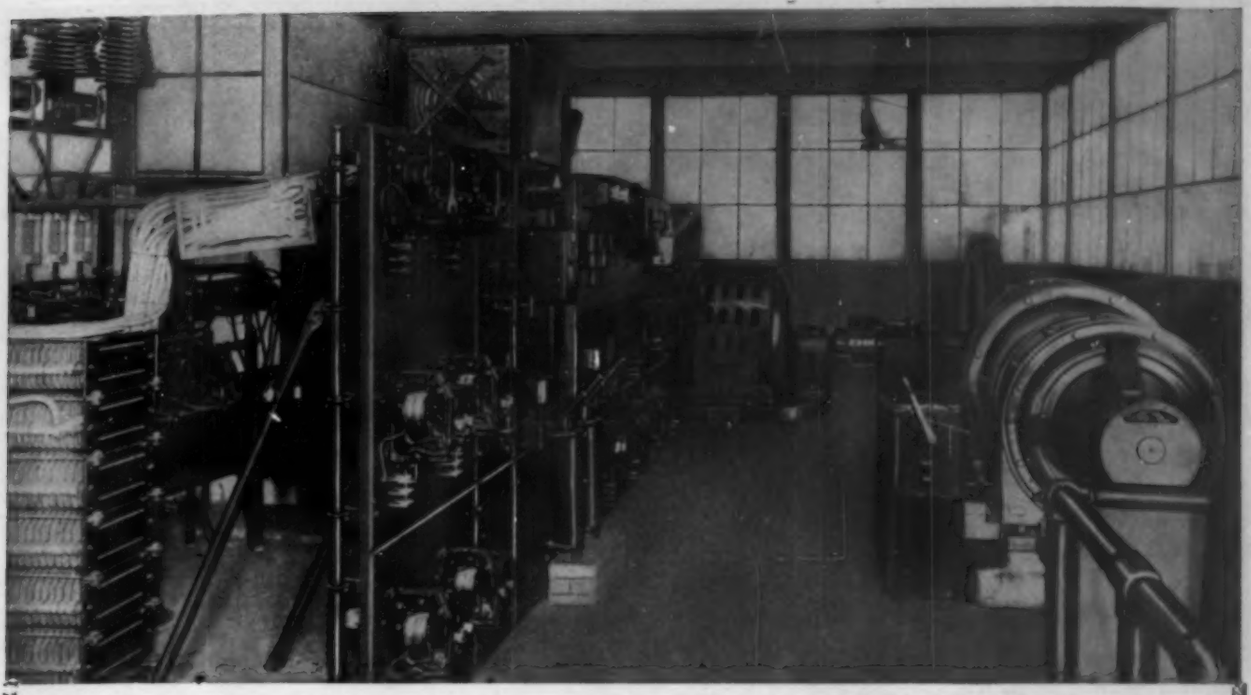
Toronto, Canadian Link-Belt Co., Ltd.


The Robinson Clay Product Company
Akron, Ohio
September 28th, 1914
Link-Belt Company,
Cleveland, Ohio.
Gentlemen:—Six or seven years ago, we installed a lot of motors at one of our plants, direct connected to our dry pans. Because of the excessive vibration on these pans, we found that we could not thus drive them. We then put in Silent Chain Drives, manufactured by your Company, and since that time have had positively no difficulty. There is no shock on the motors, due to the chain, and have had no motor trouble. This is no doubt due to the flexibility of the chain.
Yours truly,
(Signed) JOHN J. STARR
Secretary.



Adjustable Speed Control for Standard Induction Motor Main Roll Drives. American Iron & Steel Company, Lebanon, Pa.

Roll all Your Sections at Most Efficient Speed

The General Electric Company has perfected a new roll drive which can be the means of greatly increasing your production. This drive attains high efficiency over a range of speed control wide enough to accommodate every kind of section in the range for which the electric drive was designed, and when an adjustment has been made for one speed, that speed remains constant throughout all variations in load.

This great advance in standard induction motor main roll drives, has been made without losing the well-known advantages of the induction motor itself. The new drive is rugged, dependable, has large overload capacity and high starting and maximum torques, in fact it has all the best points desired in rolling mill drives.

Moreover it is not an experiment. There are 45 installations, in operation or under construction, which have given entire satisfaction.

You are invited to make an investigation which will place you under no obligations.

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6601

MORE AND BETTER PRODUCT AT REDUCED POWER COST

Advertising Chat

By ERNEST V. MADISON

LET'S be reminiscent today. Sort o' draw up our chairs by the fire, light our pipes and ramblingly talk over characteristics and evolutions of the technical press.

¶ The technical paper is peculiar unto itself. Its advertising pages equal its editorial pages in giving service to the reader.

¶ Suppose, for instance, a law were passed tomorrow prohibiting *The Iron Trade Review* from publishing another advertisement. How many of its subscribers do you believe would renew their subscriptions at their expiration? *Would the paper be as interesting to you?*

¶ Back of every technical paper is its editorial policy. The policy of the wise editor, nowadays, is to make his paper more of a service than of a few pages of literature. Consider the different features of *The Iron Trade Review* which are designed to help you with the problems you encounter in your actual work. Quite a far step from the type of technical paper of a few years ago, whose pages were filled with advertising write-ups.

¶ The advertising departments of the manufacturers believed they were doing the field a real service in supplying these write-ups. The editors believed it good policy to publish them. Neither is to be censured for doing what they believed to be right. Nevertheless, the evolution of publishing policy to the point where reading pages are given over to *subjects of service* and to field topics of real interest to readers contributes to a wider influence of the technical paper.

¶ This change has come with the years. Like all other great changes it has been a matter of evolution—of educating publishers, readers and advertisers to *think* and *strive* toward higher ideals. And this is the technical paper field of today. Throughout its body, thousands of ideas are working and building and creating changes within itself.

¶ No other publishing field within the last score of years has made the proportionate strides forward of the technical paper field. Who can prophesy of its prestige, service and efficiency a score of years hence?

Say you saw it in THE IRON TRADE REVIEW

CLEVELAND, OHIO, DECEMBER 28, 1916

THE IRON TRADE REVIEW

A weekly publication devoted to the Iron, Steel, Machinery and Foundry Industries of the United States and Canada

Published Every Thursday by THE PENTON PUBLISHING CO., Cleveland

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BRANCH OFFICES

CHICAGO	1521-23 Lytton Bldg.	PITTSBURGH	2148-49 Oliver Bldg.
CINCINNATI	404 Johnston Bldg.	WASHINGTON, D. C.	206 Corcoran Bldg.
NEW YORK	508 West St. Bldg.	BIRMINGHAM, ENG.	Princes Chambers

Subscription, United States and Mexico, $4 per year. Canada, $6, and other Foreign Countries, $8 per year.

Entered at the Postoffice at Cleveland as Second Class Matter.

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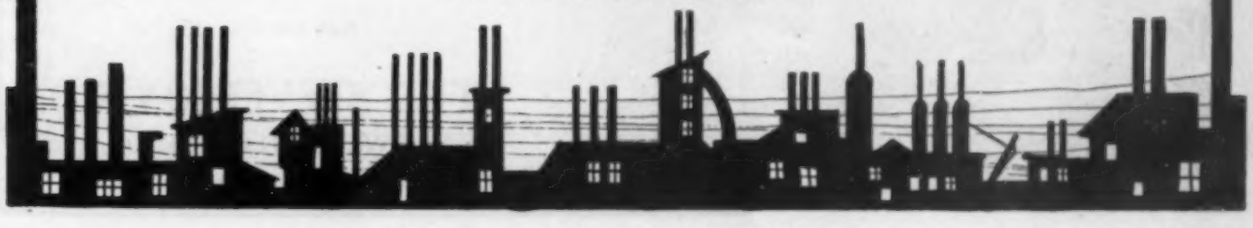

"He Sez, Sez 'ee

The ole man does as 'ee comes a nosin' 'round, 'Jim' sez 'ee, 'that's the corkinest Elevator we've got around the whole dog-on shebang', sez 'ee."

Was the way Jim, the old engineer expressed himself to us the other day—and we pass it on to you as about as good a testimonial as the "Old Man," could dictate himself over at the office.

We will be glad to refer you to the "Ole Man" himself, if Jim smells too strong of his pipe and is too greasy in his clothes for a nice refined office man, lately out of college,—like you.

Hundreds and hundreds of mill owners who have gotten Ridgway Steam Hydraulic Elevators are saying the same thing as old Jim's Boss.

The Ridgway Elevator is so far superior to all other elevators there is **Absolutely No Comparison.**

We've told you the reason why two thousand times.

And given you two thousand firms to cry "Amen"

But here they go again:—

1. Run at virtually no cost.
2. Absolutely fool proof.
3. No repairs.
4. Always go.
5. Go when engine is shut down.

NO PAY UNTIL IT MAKES GOOD.

These are the reasons why Jim's Ole Man and Smart Ones like him

"HOOK 'ER TO THE BILER"

CRAIG RIDGWAY & SON COATESVILLE, PA.
ELEVATOR MAKERS TO FOLKS WHO KNOW

Direct Acting

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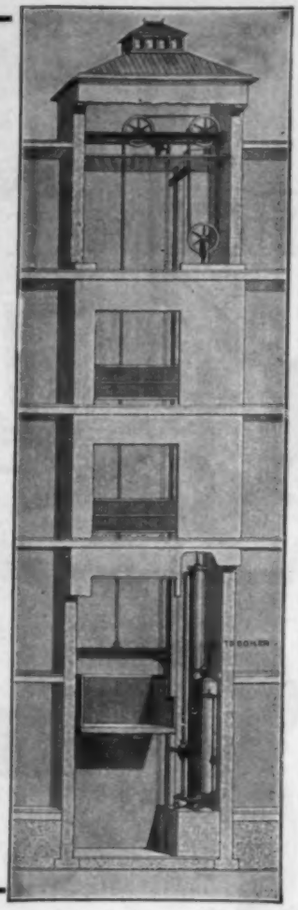

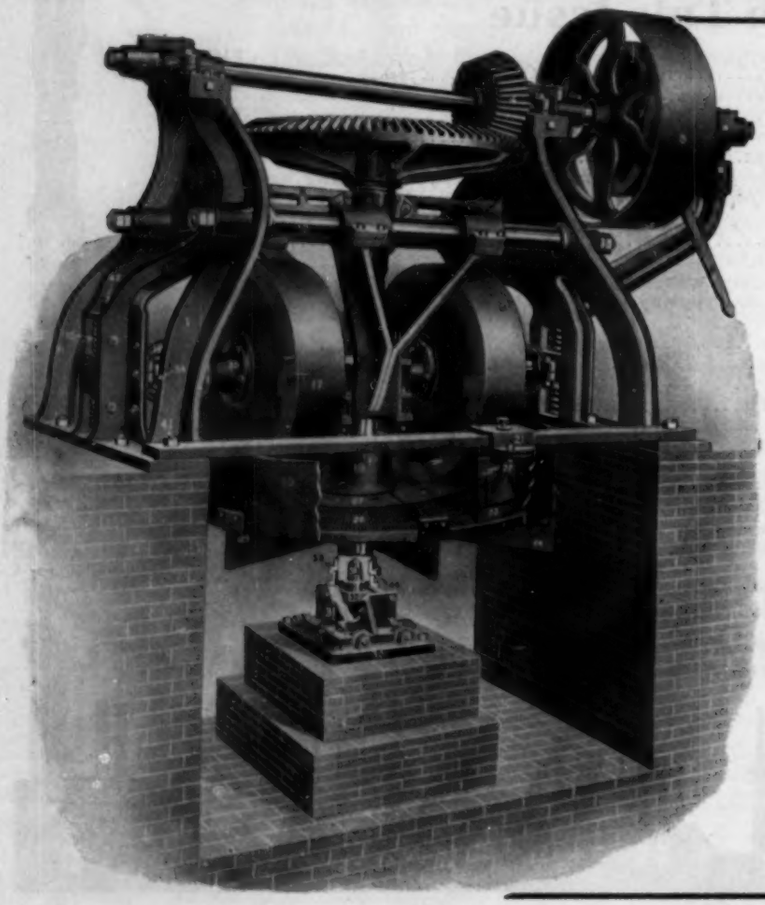

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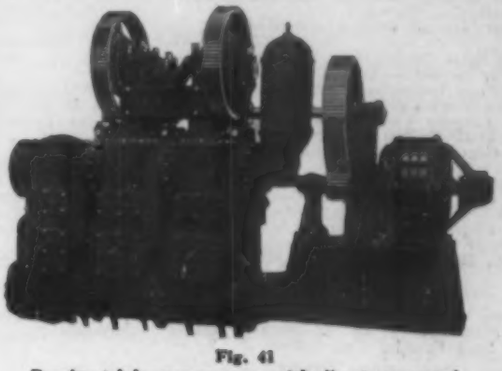

Fig. 41
Deming triplex power pump with direct connected electric motor.

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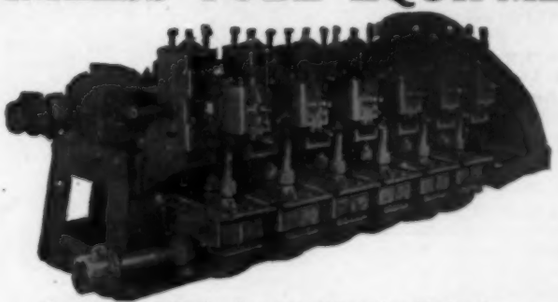

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Blackwood Steel Fdy. Co., The, Springfield, O.
Blystone Mfg. Co., Cambridge Springs, Pa.
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Federal Steel Foundry Co., Chester, Pa.
Hubbard Steel Foundry Co., E. Chicago, Ind.
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St. Louis Steel Foundry, St. Louis, Mo.
Sharon Foundry Co., Sharon, Pa.
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Wheeling Mold & Foundry Co., Pittsburgh, Pa.

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Link-Belt Company, Chicago, Ill.

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Link-Belt Company, Chicago, Ill.
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Link-Belt Company, Chicago, Ill.

CHAINS.
(Power Transmitting.)
Link-Belt Company, Chicago, Ill.

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Lakewood Engrg. Co., Cleveland, O.

CHARGING BUGGY.
Lakewood Engrg. Co., Cleveland, O.

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Marshall Foundry Co., Pittsburgh, Pa.

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Link-Belt Company, Chicago, Ill.

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Columbus Iron & Steel Co., Columbus, O.
Eaton, Rhodes & Co., Cincinnati, O.
Hanna, M. A., & Co., Cleveland, O.
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(See Engineers and Contractors.)

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Wellman-Seaver-Morgan Co., Cleveland, O.

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Browning Co., The, Cleveland, O.
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Industrial Works, Bay City, Mich.
Link-Belt Company, Chicago, Ill.
McMyler Interstate Co., Cleveland, O.
Morgan Engineering Co., Alliance, O.
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Northern Engineering Works, Detroit, Mich.
Orton & Steinbrenner Co., Chicago, Ill.
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Link-Belt Company, Chicago, Ill.
Niles-Bement-Pond Co., New York, N. Y.
Northern Enginering Works, Detroit, Mich.
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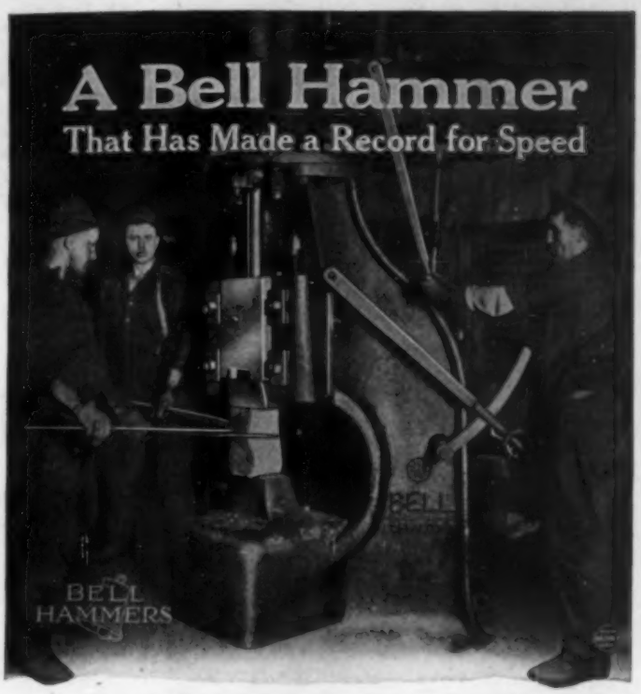

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Thompson Electric Welding Co., Lynn, Mass.
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Oxweld Acetylene Co., Chicago, Ill.
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Peerless Machine Co., Racine, Wis.
Q. M. S. Company, The, Chicago, Ill.
Southwark Fdy. & Mch. Co., Philadelphia, Pa.

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National Tube Co., Pittsburgh, Pa.

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Landis Machine Co., Waynesboro, Pa.
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Modern Tool Co., Erie, Pa.
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Sivyer Steel Casting Co., Milwaukee, Wis.
Toledo Machine & Tool Co., Toledo, O.

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DIES.
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Davison, Allen S., Company, Pittsburgh, Pa.

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DOORS.
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Baker Bros., Toledo, O.
Baush Machine Tool Co., Springfield, Mass.
Cleveland Pneumatic Tool Co., Cleveland, O.
National Machinery Co., The, Tiffin, O.
Newton Mach. Tool Wks., Inc., Philadelphia.
Niles-Bement-Pond Co., New York, N. Y.
Simplex Mach. Tool Co., The, Cleveland, O.

DRILLING MACHINES.
(Electric Portable.)
Van Dorn & Dutton Co., Cleveland, O.

DRILLING MACHINES.
(Pneumatic.)
Allen, John F., Co., New York City.
Cleveland Pneumatic Tool Co., Cleveland, O.

DRILLS.
American Vanadium Co., The, Pittsburgh, Pa.
Baush Machine Tool Co., Springfield, Mass.
Newton Mach. Tool Works, Inc., Philadelphia, Pa.

DRILLS.
(High Speed and Reamer.)
Latrobe Tool Co., The, Latrobe, Pa.

DRILLS.
(Rock.)
Cleveland Twist Drill Co., Cleveland, O.
Wickes Brothers, Saginaw, Mich.

DRYERS.
(Ore.)
American Process Co., New York City.
Lehigh Car, Wheel & Axle Works, Catasauqua, Pa.

DRY PANS.
Stevenson Company, The, Wellsville, O.

DUST ARRESTING SYSTEM.
Whiting Foundry Equipment Co., Harvey, Ill.

ELECTRICAL INSTRUMENTS.
(Repaired and Tested.)
Stupakoff Laboratories, Pittsburgh, Pa.

ELECTRICAL WIRES AND CABLES.
Roebling's, John A., Sons Co., Trenton, N. J.

ELECTRIC EQUIPMENT.
Electric Controller & Mfg. Co., Cleveland, O.
Pfannmueller Engineering Co., Chicago, Ill.

ELECTRIC LIGHT EQUIPMENT.
Crocker-Wheeler Co., Ampere, N. J.
Link-Belt Company, Chicago, Ill.
Smith Gas Engrg. Co., The, Lexington, O.

ELEVATORS.
Ridgway, Craig, & Son, Coatesville, Pa.
Whiting Foundry Equipment Co., Harvey, Ill.

ELEVATORS.
(Bucket.)
Link-Belt Company, Chicago, Ill.

ENGINEERS AND CONTRACTORS.
Abramsen Engineering Co., Pittsburgh, Pa.
Alliance Structural Co., Alliance, O.
American Bridge Co., New York, N. Y.
Blair Engineering Co., Chicago, Ill.
Blaw Steel Construction Co., Hoboken, Pa.
Eichleay, John J., Co., Pittsburgh, Pa.
Frazier & Sheal Co., Cleveland, O.
Freyn, Heinrich J., Inc., Chicago, Ill.
General Briquetting Co., New York City.
Hunt, Robert W., & Co., Chicago, Ill.
Kratzer, W. N., & Co., Pittsburgh, Pa.
Laughlin, Alex., & Co., Pittsburgh, Pa.
McClintic-Marshall Co., Pittsburgh, Pa.
McClure, Geo. W., Son & Co., Pittsburgh, Pa.
McKee, Arthur G., & Co., Cleveland, O.
Mesta Machine Co., Pittsburgh, Pa.
Morgan Engineering Co., Alliance, O.
Pittsburgh Pip'g & Equipment Co., Pittsburgh.
Rinehart, J. W., Cleveland, O.
Smythe, S. R., The, Co., Pittsburgh, Pa.
Swindell, Wm., & Bros., Pittsburgh, Pa.
Tod, Wm., Co., Youngstown, O.
Treadwell Engineering Co., Easton, Pa.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
Wellman-Seaver-Morgan Co., Cleveland, O.

ENGINEERS.
(Consulting.)
Duff, Samuel E., Pittsburgh, Pa.
Frazier & Sheal Co., Cleveland, O.
Freyn, Heinrich J., Inc., Chicago, Ill.
General Briquetting Co., New York, N. Y.
Moore, Frederick C., Cleveland, O.
Moore, W. E., & Co., Pittsburgh, Pa.

ENGINEERS.
(Foundry, Mechanical and Electrical.)
General Briquetting Co., New York City.
Standard Sand & Mch. Co., Cleveland, O.

ENGINES.
(Fully Enclosed and Self-Oiling.)
Wachs, E. H., Company, Chicago, Ill.

ENGINES.
(Gas, Gasoline and Oil.)
Cooper, C. & G., Co., Mt. Vernon, O.
Mesta Machine Co., Pittsburgh, Pa.
Tod, Wm., Co., Youngstown, O.

ENGINES.
(Hoisting.)
Dake Engine Co., Grand Haven, Mich.
Vulcan Iron Works, Wilkesbarre, Pa.

ENGINES.
(Steam.)
Cooper, C. & G., Co., Mt. Vernon, O.
Dake Engine Co., Grand Haven, Mich.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Mesta Machine Co., Pittsburgh, Pa.
Phoenix Iron Works Co., Meadville, Pa.
Standard Scale & Supply Co., Pittsburgh, Pa.
Tod, Wm., Co., Youngstown, O.
Vulcan Iron Works, Wilkesbarre, Pa.
Wachs, E. H., Company, Chicago, Ill.

ENGINES.
(Stoker.)
Wachs, E. H., Company, Chicago, Ill.

ENGINES.
(Vertical.)
Wachs, E. H., Company, Chicago, Ill.

ENGRAVERS.
(Steel and Copper Plate.)
Wiggins, John B., Co., Chicago, Ill.

ENGRAVERS.
(Steel, Die and Stamps.)
Matthews, Jas. H., & Co., Pittsburgh, Pa.

EXHAUSTERS.
(Gas.)
Connersville Blower Co., The, Connersville, Ind.
Roots Co., P. H., & F. M., Connersville, Ind.

EXPANDED METAL LATHE.
Youngstown Iron & Steel Co., Youngstown, O.

EYEBARS.
American Bridge Co., New York, N. Y.

FACINGS.
(Foundry.)
Blystone Mfg. Co., Cambridge Springs, Pa.

FENCE GATES.
American Steel & Wire Co., Chicago, Ill.

FENCING.
Youngstown Sh't & Tube Co., Youngstown, O.

FERRO-ALLOYS.
Davison, Allen S., Co., Pittsburgh, Pa.

FERRO-CARBON TITANIUM.
Titanium Alloy Mfg. Co., Niagara Falls, N. Y.

FERRO-MANGANESE.
Blackwell, Geo. G., & Sons, Ltd., Liverpool, England.
Crocker Bros., New York City.
Mohr, J. J., & Son, Philadelphia, Pa.
Rogers, Brown & Co., Cincinnati, O.
Samuel, Frank, Philadelphia, Pa.

FERRO-SILICON.
Blackwell, Geo. G., & Sons, Ltd., Liverpool, England.
Crocker Bros., New York City.
Davison, Allen S., Company, Pittsburgh, Pa.
Mohr, J. J., & Son, Philadelphia, Pa.
Rogers, Brown & Co., Cincinnati, O.
Samuel, Frank, Philadelphia, Pa.
Tennessee Coal, Iron & R. R. Co., Birmingham, Ala.

FERRO TUNGSTEN.
Vanadium Alloys Steel Co., Pittsburgh, Pa.

FERRO-VANADIUM.
American Vanadium Co., Pittsburgh, Pa.

FILES.
Barnett, G. & H., Co., Philadelphia, Pa.
Disston, Henry, & Sons, Inc., Philadelphia.
Nicholson File Co., Providence, R. I.

FIRE BRICK AND CLAY.
Blackwell, Geo. G., Sons & Co., Ltd., Liverpool, England.
Clearfield Fire Brick Co., Clearfield, Pa.
Dover Fire Brick Co., Cleveland, O.
Eureka Fire Brick Works, Mt. Braddock, Pa.
Harbison-Walker Refractories Co., Pittsburgh.
Kier Fire Brick Co., Pittsburgh, Pa.
Louisville Fire Brick Co., Highland Park, Ky.
Mutton Hollow Fire Brick Co., The, Woodbridge, N. J.
Portsmouth Refractories Co., Portsmouth, O.
Queens Run Fire Brick Co., Lock Haven, Pa.
Soisson, Jos., Fire Brick Co., Connellsville, Pa.
Union Mining Co., Mt. Savage, Md.

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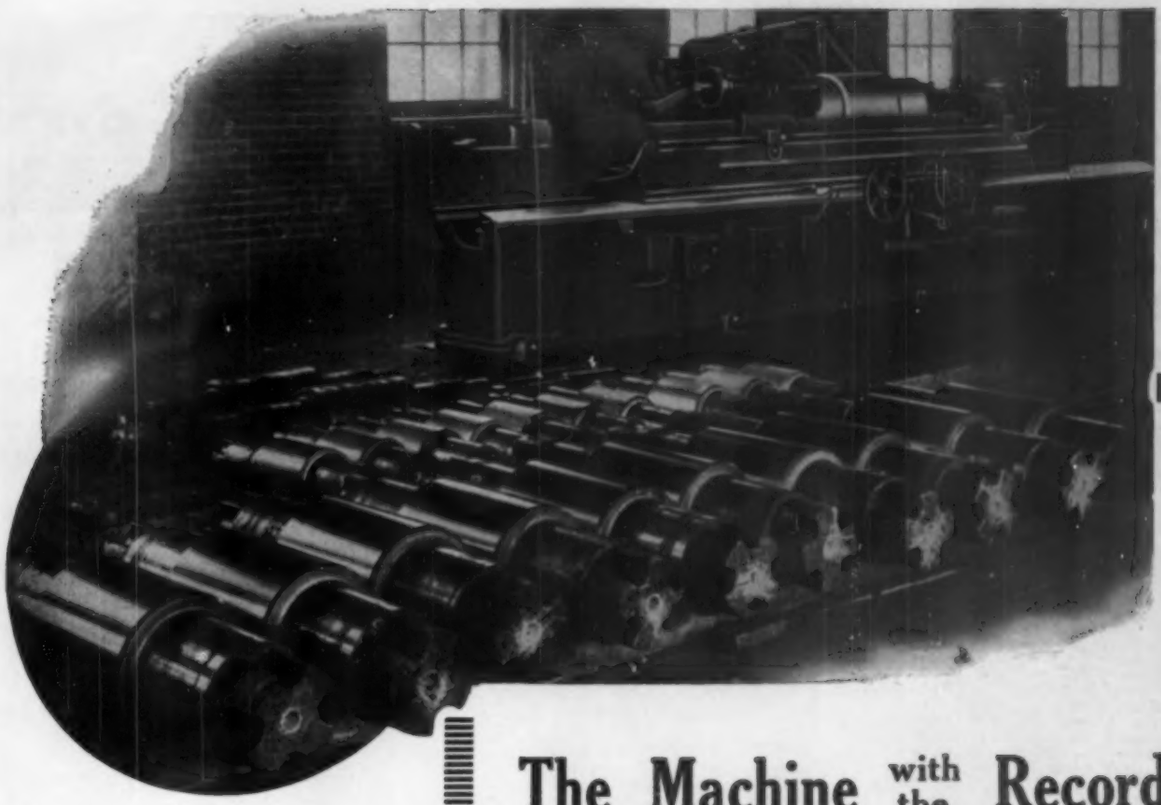


The Machine with the Record

Speed, efficiency and economy all combine to produce this record-breaking machine.

This NORTON GRINDING MACHINE in the plant of the ***Weirton Steel Company, Weirton, W. Va.,*** is a TYPICAL—not an ***exceptional*** "NORTON."

The owner of this machine has written us:

> ***"It operates as smoothly . . . the most expensive watch, and gives a mirror-like surface to the rolls, thereby increasing their efficiency."***

The above is true of ***every*** Norton Grinding Machine.

The Weirton Steel Company is using the machine shown above for grinding rolls.

16" diameter, 20" face;	8" diameter, 10" face;
12" diameter, 16" face;	6" diameter, 10" face.

Rolls of 16" diameter are ground in from 1 to 1½ hours.

The Chilled Rolls shown in foreground of illustration are for use on mills for rolling bright finished, cold rolled strip steel.

Tell us about the conditions in your plant—or ask us to send you further details.

NORTON GRINDING CO., WORCESTER, MASS.

CHICAGO STORE, 11 NO. JEFFERSON STREET

AGENTS: Vonnegut Machinery Co., Indianapolis. **Robinson, Cary & Sands Co.,** St. Paul and Duluth. **Manning, Maxwell & Moore, Inc.,** St. Louis. **The Motch & Merryweather Machinery Co.,** Cleveland, Pittsburgh, Cincinnati and Detroit. **Eccles & Smith Company,** San Francisco, Portland, Ore., and Los Angeles. **Prentiss Tool & Supply Co.,** New York, Boston, Rochester, Buffalo, Syracuse and Scranton. **W. E. Shipley Machinery Co.,** Philadelphia. **Kemp Machinery Co.,** Baltimore. **C. T. Patterson Co., Ltd.,** New Orleans. **Canadian Fairbanks-Morse Co.,** Montreal, Toronto and Vancouver. **Alfred Herbert, Ltd.,** Coventry, England, Paris and Milan. **Post Van Der Burg & Co.,** Rotterdam, Holland. **The F. W. Horne Co.,** Tokio, Japan. 471 N

FIRE CLAY.
(Ground.)
Union Mining Co., Mt. Savage, Md.

FLANGES.
(Pipe.)
Dart, E. M., Mfg. Co., Providence, R. I.
National Tube Co., Pittsburgh, Pa.
Pittsburgh Piping & Equip. Co., Pittsburgh.

FLAT WIRE—HIGH AND LOW CARBON.
Roebling's, John A., Sons Co., Trenton, N. J.

FLUE WELDERS.
Southwark Foundry & Mach. Co., Philadelphia.

FLUOR-SPAR.
Rogers, Brown & Co., Cincinnati, O.

FLY WHEELS.
Mesta Machine Co., Pittsburgh, Pa.
Tod, Wm., Co., Youngstown, O.

FORGES.
(Hard and Soft Coal and Coke.)
Bradley, C. C., & Son, Inc., Syracuse, N. Y.

FORGING MACHINERY.
Bliss, E. W., Co., Brooklyn, N. Y.
Erie Foundry Co., The, Erie, Pa.
Mesta Machine Co., Pittsburgh, Pa.
Tod, Wm., Co., Youngstown, O.
United Engrg. & Fdy. Co., Pittsburgh, Pa.

FORGINGS.
(Bronze and Copper.)
American Manganese Bronze Co., Holmesburg, Philadelphia, Pa.
Kropp Forge Co., Chicago, Ill.

FORGINGS.
(Drop.)
Bethlehem Steel Co., The, So. Bethlehem, Pa.
Champion Mch. & Forging Co., Cleveland, O.
Columbus Forge & Iron Co., Columbus, O.
Drop Forging Co. of N. Y., Jersey City, N. J.
Eccles, Richard, Co., Auburn, N. Y.
Endicott Forging & Mfg. Co., Endicott, N. Y.
General Drop Forge Co., Buffalo, N. Y.
Oliver Iron & Steel Co., Pittsburgh, Pa.
Ingalls-Shepard Forging Co., Chicago, Ill.
Kropp Forge Co., Chicago, Ill.
Rockford Drop Forge Co., Rockford, Ill.

FORGINGS.
(Iron and Steel.)
American Bridge Co., New York, N. Y.
American Iron & Steel Mfg. Co., Lebanon, Pa.
American Rolling Mill Co., Middletown, O.
American Steel Export Co., New York City.
American Vanadium Co., The, Pittsburgh, Pa.
Bay City Forge Co., Erie, Pa.
Bethlehem Steel Co., The, So. Bethlehem, Pa.
Bradley, C. C., & Son, Inc., Syracuse, N. Y.
Camden Forge Co., Camden, N. J.
Carnegie Steel Co., Pittsburgh, Pa.
Champion Mch. & Forging Co., Cleveland, O.
Columbus Forge & Iron Co., Columbus, O.
Drop Forging Co. of N. Y., Jersey City, N. J.
Eccles, Richard, Co., Auburn, N. Y.
Ingalls-Shepard Forging Co., Chicago, Ill.
Kropp Forge Co., Chicago, Ill.
Leard, Wm. E., New Brighton, Pa.
Midvale Steel Co., Philadelphia, Pa.
Oliver Iron & Steel Co., Pittsburgh, Pa.
Otis Steel Co., Cleveland, O.
Rockford Drop Forge Co., Rockford, Ill.

FORMS.
(Special Wire.)
American Steel & Wire Co., Chicago, Ill.

FOUNDRY EQUIPMENT AND SUPPLIES.
Arcade Mfg. Co., Freeport, Ill.
Beals & Company, Buffalo, N. Y.
Blystone Mfg. Co., Cambridge Springs, Pa.
Lakewood Engrg. Co., Cleveland, O.
Northern Engineering Works, Detroit, Mich.
Oldham, Geo., & Sons Co., Frankford, Philadelphia, Pa.
Pridmore, Henry E., Chicago, Ill.
Standard Sand & Machine Co., Cleveland, O.
Whiting Foundry Equipment Co., Harvey, Ill.

FRAMES.
(Rod, Wire, Galvanizing and Tinning.)
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

FROGS.
(Railroad and Trolley.)
Bethlehem Steel Co., The., South Bethlehem, Pa.

FUEL OIL.
Texas Company, The, New York City.

FURNACE INSULATION.
Armstrong Cork & Insulation Co., Pittsburgh.
Kieselguhr Co. of America, New York City.

FURNACES.
(Annealing and Case Hardening.)
Bellevue Industrial Furnace Co., Detroit, Mich.
Gilbert & Barker Mfg. Co., Springfield, Mass.
Hagan, Geo. J., Pittsburgh, Pa.
Metals Production Equipment Co., Springfield, Mass.
Morgan Construction Co., Worcester, Mass.
Rockwell, W. S., Company, New York City.
Swindell & Bros., Wm., Pittsburgh, Pa.
Whiting Fdy. Equipment Co., Harvey, Ill.

FURNACES.
(Blast.)
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
McClure, Son & Co., G. W., Pittsburgh, Pa.
McKee, Arthur G., & Co., Cleveland, O.
Mt. Vernon Bridge Co., Mt. Vernon, O.
Riter-Conley Mfg. Co., Pittsburgh, Pa.
Tod, Wm., Co., Youngstown, O.
Wellman-Seaver-Morgan Co., Cleveland, O.

FURNACES.
(Crucible.)
Bellevue Industrial Furnace Co., Detroit, Mich.
Gilbert & Barker Mfg. Co., Springfield, Mass.
Laughlin, Alex., & Co., Pittsburgh, Pa.
Whiting Fdy. Equipment Co., Harvey, Ill.

FURNACES.
(Die Annealing.)
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

FURNACES.
(Lead, Pot and Muffle Annealing, Wire Mills.)
Bellevue Industrial Furnace Co., Detroit, Mich.
Morgan Construction Co., Worcester, Mass.
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

FURNACES.
(Open Hearth.)
Blair Engineering Co., Chicago, Ill.
Smythe, S. R., Co., Pittsburgh, Pa.
Snyder, W. P., & Co., Pittsburgh, Pa.
Whiting Foundry Equipment Co., Harvey, Ill.

FURNACES.
(Shrapnel.)
Bellevue Industrial Furnace Co., Detroit, Mich.
Gilbert & Barker Mfg. Co., Springfield, Mass.
Railway Materials Co., Chicago, Ill.
Rockwell, W. S., Co., New York City.

FURNACES.
(Spelter.)
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

FURNACES.
(Tinning.)
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

FURNACES.
(Water Cooled Specialties for Open Hearth.)
Knox Pressed & Welded Steel Co., Pittsburgh.

FURNITURE.
(Steel.)
Angle Steel Stool Co., Otsego, Mich.

GALVANIZING EQUIPMENT.
American Bridge Co., New York.
Erie Foundry Co., Erie, Pa.

GAS BOOSTERS.
(Rotary Positive Pressure.)
Connersville Blower Co., The, Connersville, Ind.
Roots, P. H., & F. M., Co., Connersville, Ind.

GAS EXHAUSTERS.
Roots, P. H. & F. M., Co., Connersville, Ind.

GAS PRODUCERS.
Chapman Engineering Co., Mt. Vernon, O.
Hagan, Geo. J., Co., Pittsburgh, Pa.
Koppers, H., Co., Pittsburgh, Pa.
Morgan Const. Co., Worcester, Mass.
Smith Gas Engrg. Co., The, Lexington, O.
Wellman-Seaver-Morgan Co., Cleveland, O.

GAS RECOVERY COKE OVENS.
Koppers, H., Co., Pittsburgh, Pa.

GAS VALVES.
Velte Foundry & Machine Co., Mars, Pa.

GASKETS.
(Leather.)
Graton & Knight Mfg. Co., The, Worcester, Mass.
Williams, I. B., & Sons, Dover, N. H.

GEAR CASES.
Nat'l Malleable Castings Co., Cleveland, O.

GEAR CUTTING MACHINERY.
Bilgram Machine Works, Philadelphia, Pa.
Newton Mch. Tool Wks., Inc., Philadelphia.

GEARS.
(Rawhide.)
Chicago Rawhide Mfg. Co., Chicago, Ill.
Horsburgh & Scott Co., Cleveland, O.
New Process Gear Corpn., Syracuse, N. Y.
Nuttall, R. D., Co., Pittsburgh, Pa.
Van Dorn & Dutton Co., Cleveland, O.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

GEARS AND GEAR CUTTING.
(Iron and Steel.)
Acme Gear Works, New York City.
American Steel Foundries, Chicago, Ill.
American Vanadium Co., The, Pittsburgh, Pa.
Bilgram Machine Works, Philadelphia, Pa.
Camden Forge Co., Camden, N. J.
Dake Engine Co., Grand Haven, Mich.
Farrell Foundry & Machine Co., Ansonia, Ct.
Fawcus Machine Co., Pittsburgh, Pa.
General Electric Co., Schenectady, N. Y.
Horsburgh & Scott, Cleveland, O.
Hubbard Steel Fdy. Co., E. Chicago, Ind.
Link-Belt Company, Chicago, Ill.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Mesta Machine Co., The, Pittsburgh, Pa.
Morgan Construction Co., Worcester, Mass.
New Process Gear Corpn., Syracuse, N. Y.
Newton Mch. Tool Works, Inc., Philadelphia.
Ross-Meehan Foundries, Chattanooga, Tenn.
Simonds Mfg. Co., Pittsburgh, Pa.
Taylor-Wharton Iron & Steel Co., High Bridge, N. J.
Taylor-Wilson Mfg. Co., McKees Rocks, Pa.
Tod, William, Co., Youngstown, O.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
Van Dorn & Dutton Co., Cleveland, O.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

GENERATORS.
(Direct and Alternating Current.)
Crocker-Wheeler Co., Ampere, N. J.
General Electric Co., Schenectady, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

GLASS.
(Wire.)
Trussed Concrete Steel Co., Detroit, Mich.

GRATE BARS.
Green Engrg. Co., Chicago, Ill.

GREASES.
Texas Company, The, New York City.

GRINDERS.
(Knife and Surface, Nail Mills.)
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

GRINDERS.
(Oil Stone.)
Oliver Machy. Co., Grand Rapids, Mich.

GRINDERS.
(Ore.)
Chalmers & Williams, Chicago Heights, Ill.

GRINDERS.
(Pneumatic.)
Cleveland Pneumatic Tool Co., Cleveland, O.

GRINDING MACHINES.
(Crank Shaft.)
Modern Tool Co., Erie, Pa.

GRINDING MACHINES.
(Cylindrical.)
Modern Tool Co., Erie, Pa.
Norton Grinding Co., Worcester, Mass.

GRINDING MACHINES.
(Die.)
Modern Tool Co., Erie, Pa.

GRINDING MACHINES.
(Motor Driven.)
Blake & Johnson Co., Waterbury, Conn.
Cincinnati Electrical Tool Co., Cincinnati, O.
Modern Tool Co., Erie, Pa.
Newton Mch. Tool Works, Inc., Philadelphia.
Norton Grinding Co., Worcester, Mass.

GRINDING PANS.
Phillips & McLaren Co., Pittsburgh, Pa.
Stevenson Company, The, Wellsville, O.

GRINDING WHEEL STANDS.
Norton Grinding Co., Worcester, Mass.

HAMMERS.
(Drop.)
Alliance Machine Co., Alliance, O.
Bliss, E. W., Co., Brooklyn, N. Y.
Buffalo Fdy. & Machine Co., Buffalo, N. Y.
Chambersburg Engrg. Co., Chambersburg, Pa.
Erie Foundry Co., Erie, Pa.
Niles-Bement-Pond Co., New York, N. Y.
Toledo Machine & Tool Co., Toledo, O.
United Engrg. & Fdy. Co., Pittsburgh, Pa.

HAMMERS.
(Power.)
Beaudry & Co., Inc., Boston, Mass.
Bradley, C. C., & Son, Inc., Syracuse, N. Y.
Buffalo Foundry & Machine Co., Buffalo, N. Y.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cleveland Pneumatic Tool Co., Cleveland, O.
Cleveland Punch & Shear Works Co., Cleveland, O.
Erie Foundry Co., Erie, Pa.
Niles-Bement-Pond Co., New York, N. Y.
O. M. S. Company, The, Chicago, Ill.
Toledo Machine & Tool Co., Toledo, O.

HAMMERS.
(Rawhide.)
Chicago Rawhide Mfg. Co., Chicago, Ill.

HARDWARE WAGONS.
Oliver Iron & Steel Co., Pittsburgh, Pa.

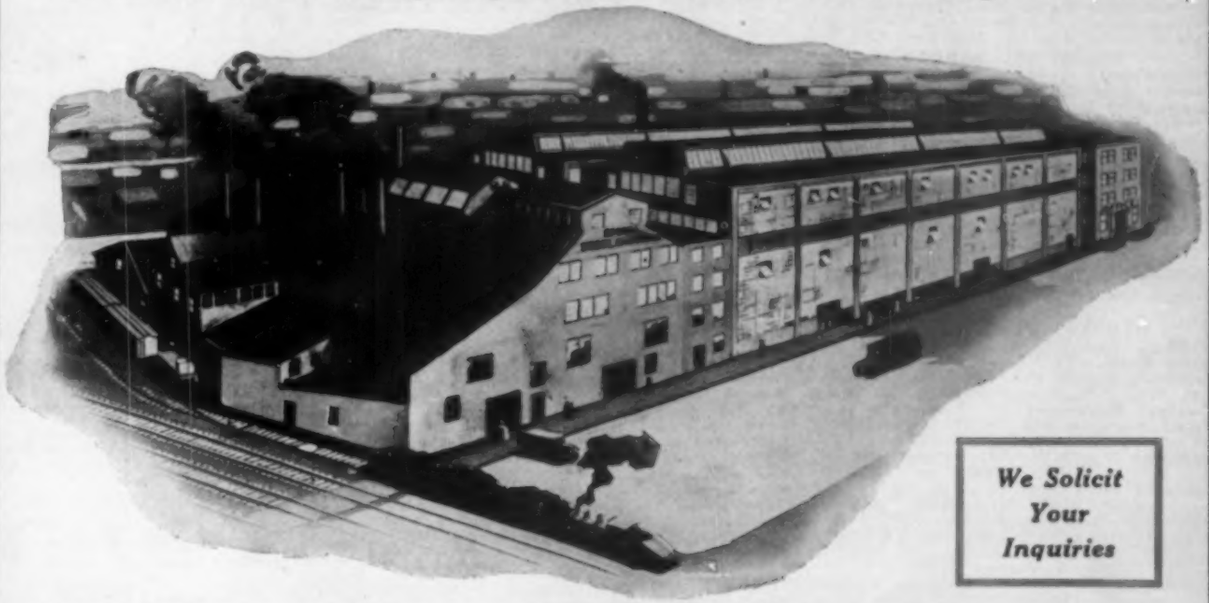
HEADERS.
(Welded.)
Best Company, Pittsburgh, Pa.

See Index to Advertisements for Pages Containing Advertisements of Companies Listed Above

CASTINGS

OUR NEW STEEL FOUNDRY

is equipped and ready for operation. We can give you immediate service on steel casting requirements—200 to 300 tons per month.



We Solicit Your Inquiries

THE WEST STEEL CASTING COMPANY, Cleveland, O.

STEEL CASTINGS

ELECTRICAL - MACHINERY - MANGANESE - AUTO

SERVICE QUALITY VALUE

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MILWAUKEE, WIS.

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STEEL CASTINGS

Reading Steel Casting Co.

READING, PA.

Sharon Foundry Co.

STEEL CASTINGS

ACID OPEN HEARTH

We solicit your business and guarantee satisfaction

Sharon, Pa.

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KEYSTONE

products include

Brass, Bronze and Copper Castings for Blast Furnaces and Rolling Mills

Open Hearth, Water Cooled Copper Doors, Frames and Ports. Also Tuyeres, Coolers, Bosh Plates, Valve Seats and Cinder Taps. Mill Bearings for Tin and Sheet Mills, Cold Mills, Rod Mills, Bar and Guide Mills.

KEYSTONE BRONZE COMPANY

General Offices: 39th St., Pittsburgh, Pa.

HEAT INSULATING.
(Brick and Powder.)
Kieselguhr Co. of America, New York City.

HEAT TREATING.
Bidle, W. S., Co., Cleveland, O.
Steel Improvement Co., Cleveland, O.

HOISTING MACHINERY.
Alliance Machine Co., Alliance, O.
Browning Co., The, Cleveland, O.
Chisholm & Moore Mfg. Co., The, Cleveland.
Dake Engine Co., Grand Haven, Mich.
Detroit Hoist & Mach. Co., Detroit, Mich.
Euclid Crane & Hoist Co., Euclid, O.
Hendrick Mfg. Co., Carbondale, Pa.
Illinois Malleable Iron Co., Chicago, Ill.
Link-Belt Company, Chicago, Ill.
Morgan Engineering Co., Alliance, O.
Niles-Bement-Pond Co., New York, N. Y.
Northern Engineering Works, Detroit, Mich.
Pawling & Harnischfeger Co., Milwaukee, Wis.
O. M. S. Company, The, Chicago, Ill.
Ridgway & Son, Craig, Coatesville, Pa.
Shepard Electric Crane & Hoist Co., Montour Falls, N. Y.
Toledo Bridge & Crane Co., Toledo, O.
Wellman-Seaver-Morgan Co., Cleveland, O.
Whiting Foundry Equipment Co., Harvey, Ill.
Yale & Towne Mfg. Co., New York City.

HOOPS AND BANDS.
Bourne-Fuller Co., The, Cleveland, O.
Carnegie Steel Co., Pittsburgh, Pa.
Illinois Steel Co., Chicago, Ill.
Ryerson, Joseph T., & Son, Chicago, Ill.
Scully Steel & Iron Co., Chicago, Ill.

HOOPS.
(Wire.)
American Steel & Wire Co., Chicago, Ill.

HORSE SHOES AND CALKS.
American Steel & Wire Co., Chicago, Ill.

HOSE.
(Pneumatic.)
Cleveland Pneumatic Tool Co., Cleveland, O.
Oldham, Geo., & Son Co., Frankford, Philadelphia, Pa.

HYDRAULIC MACHINERY.
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Mesta Machine Co., Pittsburgh, Pa.
Southwark Fdy. & Mch. Co., Philadelphia, Pa.
Tod, Wm., Co., Youngstown, O.
Treadwell Engineering Co., Easton, Pa.
United Engrg. & Fdy. Co., Pittsburgh, Pa.

HYDRAULIC PRESSES.
Southwark Fdy. & Mch. Co., Philadelphia, Pa.

INGOT CARS.
Lakewood Engrg. Co., Cleveland, O.

INGOT MOLDS.
Marshall Foundry Co., Pittsburgh, Pa.
Penn Mold & Mfg. Co., Wheeling, W. Va.

INGOTS.
(Electric Furnace Steel.)
Latrobe Electric Steel Co., Latrobe, Pa.

INSPECTORS.
(Heat Treated Metal.)
Pennsylvania Inspection Bureau, Johnstown, Pa.

INSTRUMENTS.
(Electric Indicating and Recording.)
General Electric Co., Schenectady, N. Y.
Smith Gas Engrg. Co., The, Lexington, O.

INSULATED WIRES AND CABLES.
Roebling's, John A., Sons Co., Trenton, N. J.

INSULATING BRICK.
Armstrong Cork & Insulation Co., Pittsburgh.
Kieselguhr Co. of America, New York City.

INSULATION.
(Furnaces, Boiler Settings, Oven, Steam Pipe, etc.)
Armstrong Cork & Insulation Co., Pittsburgh.
Kieselguhr Co. of America, New York City.

IRON.
(Basic—Bessemer—Malleable.)
Inland Steel Co., Chicago, Ill.

IRON.
(Chain.)
Bethlehem Steel Co., The, So. Bethlehem, Pa.

IRON.
(Ornamental.)
Belmont Iron Works, Philadelphia, Pa.

IRON.
(Staybolt.)
American Iron & Steel Mfg. Co., Lebanon, Pa.
Bethlehem Steel Co., The, So. Bethlehem, Pa.
Bourne-Fuller Company, Cleveland, O.

IRON AND STEEL.
American Vanadium Co., The, Pittsburgh, Pa.
Beals & Co., Buffalo, N. Y.
Bourne-Fuller Co., The, Cleveland, O.
Ryerson, Jos. T., & Son, Chicago, Ill.
Scully Steel & Iron Co., Chicago, Ill.
Westerman & Co., Lockport, N. Y.

IRON AND STEEL.
(Galvanized.)
Bourne-Fuller Co., The, Cleveland, O.
McCalla, Harold, Philadelphia, Pa.
Whitaker-Glessner Co., Portsmouth Works, Portsmouth, O.
Youngstown Sheet & Tube Co., Youngstown, O.

IRON AND STEEL.
(Scrap.)
American Bridge Co., New York N. Y.
U. S. Metal & Mfg. Co., New York City.

IRON ORE.
Blackwell, Geo. G., Sons & Co., Ltd., Liverpool, England.
Breitung, E. N., & Co., Cleveland, O.
Hanna, M. A., & Co., Cleveland, O.
Hillman, J. H., & Sons Co., Pittsburgh, Pa.
La Belle Iron Works, Steubenville, O.
Oglebay, Norton & Co., Cleveland, O.
Pickands, Mather & Co., Cleveland, O.
Snyder, W. P., & Co., Pittsburgh, Pa.
Tod-Stambaugh Co., Cleveland, O.

JAPANNING OVENS.
Young Brothers Company, Detroit, Mich.

JIGS, FIXTURES AND TOOLS.
Marvin & Casler Co., Canastota, N. Y.
Parker Machine Company, Boston, Mass.
Scott, Geo. H., Machine Co., Cleveland, Ohio.

JOLT RAMMING MACHINES.
Pridmore, Henry E., Chicago, Ill.

KEYS AND COTTERS.
(Machine.)
Leard, Wm. E., New Brighton Pa.
Moltrup Steel Products Co., Beaver Falls, Pa.
Morton Mfg. Co., Muskegon Heights, Mich.
Standard Gauge Steel Co., Beaver, Falls, Pa.

KEYSEATERS.
Baker Bros., Toledo, O.
Mitts & Merrill, Saginaw, Mich.

LABORATORIES.
Hunt, Robert W., & Co., Chicago, Ill.

LADLE BOWLS.
(Steel.)
Byram Company, Detroit, Mich.

LADLES.
Northern Engineering Works, Detroit, Mich.
Whiting Foundry Equipment Co., Harvey, Ill.

LAMPS.
(Arc and Incandescent.)
General Electric Co., Schenectady, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

LATH.
(Expanded Metal.)
Trussed Concrete Steel Co., Detroit, Mich.
Youngstown Iron & Steel Co., Youngstown, O.

LATHES.
Cincinnati Iron & Steel Co., Cincinnati, O.
Jones & Lamson Mach. Co., Springfield, Vt.
Manning, Maxwell & Moore, Inc., New York, N. Y.
Mesta Machine Co., Pittsburgh, Pa.
Morgan Construction Co., Worcester, Mass.
New Britain Mach. Co., New Britain, Conn.
Niles-Bement-Pond Co., New York, N. Y.
Oliver Machy. Co., Grand Rapids, Mich.
Simplex Mach. Tool Co., The, Cleveland, O.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
Youngstown Fdy. & Mch. Co., Youngstown, O.

LATHES.
(Die Reaming.)
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

LATHES.
(Engine.)
Oliver Machinery Co., Grand Rapids Mich.

LATHES.
(Turret.)
Oliver Machinery Co., Grand Rapids, Mich.

LEATHER.
(Hydraulic.)
Graton & Knight Mfg. Co., Worcester, Mass.
Williams, I. B., & Sons, Dover, N. H.

LEATHER BELTING.
(See Belting Leather.)

LETTERS AND FIGURES.
(Steel, Hand Made.)
Matthews, Jas. H., & Co., Pittsburgh, Pa.

LETTERHEADS.
(Engraved.)
Wiggins, John B., Co., Chicago, Ill.

LIFTING MAGNETS.
Cutler-Hammer Mfg. Co., Milwaukee, Wis.
Electric Controller & Mfg. Co., Cleveland, O.

LIMESTONE.
(Agricultural.)
Davison, Allen S. Co., Pittsburgh, Pa.

LIMESTONE.
(Crushed.)
Davison, Allen S., Co., Pittsburgh, Pa.

LININGS.
(Cupola, Furnace and Forge.)
Harbison-Walker Refractories Co., Pittsburgh.

LINK BELTING.
Link-Belt Company, Chicago, Ill.

LOCOMOTIVES.
General Electric Co., Schenectady, N. Y.
Vulcan Iron Works, Wilkesbarre, Pa.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

LOCOMOTIVES.
(Electric.)
Atlas Car & Mfg. Co., Cleveland, O.
Baldwin Locomotive Works, Philadelphia, Pa.

LOCOMOTIVES.
(Second Hand.)
Zelnicker, Walter A., Supply Co., St. Louis.

LUBRICANTS.
Texas Company, The, New York City.

LUMBER.
(Boxing, Crating, Flask, Pattern and Templet.)
Johnson Lumber Co., Milwaukee, Wis.

MACHINE COUNTERS.
Hart, R. A., Mfg. Co., Battle Creek, Mich.

MACHINE KEYS.
(See Keys and Cotters, Machine.)

MACHINE WORK.
American Shoe Mchy. & Tool Co., St. Louis.
American Twist Drill Co., Laconia, N. H.
Dunkirk Machine & Boiler Co., Dunkirk, N. Y.
Hill Pump Valve Co., Chicago, Ill.
Klein Iron Works Company, Bellevue, Ohio.
Klotz Machine Co., Saudusky, O.
Marvin & Casler Co., Canastota, N. Y.
Murray Iron Works Co., Burlington, Iowa.
Wellman Pattern Supply Co., Cleveland, Ohio.

MACHINERY.
(Sand Sifting.)
Blystone Mfg. Co., Cambridge Springs, Pa.

MACHINERY.
(See Second Hand Machinery.)

MACHINISTS.
Adamson Machine Co., Akron, O.
Blake & Johnson Co., Waterbury, Conn.
Bliss, E. W., Brooklyn, N. Y.
Buffalo Fdy. & Mach. Co., Buffalo, N. Y.
Dake Engine Co., Grand Haven, Mich.
Erie Foundry Co., Erie, Pa.
Fawcus Machine Co., Pittsburgh, Pa.
Hanna Engineering Works, Chicago, Ill.
Hilles & Jones, Wilmington, Del.
Link-Belt Company, Chicago, Ill.
Manning, Maxwell & Moore, Inc., New York, N. Y.
Mesta Machine Co., Pittsburgh, Pa.
Morgan Engrg. Co., Alliance, O.
Tod, Wm., Co., Youngstown, O.
Toledo Mach. & Tool Co., Toledo, O.

MAGNESITE.
American Refractories Co., Chicago, Ill.

MAGNESITE.
(Calcined.)
Davison, Allen S., Co., Pittsburgh, Pa.

MASON CONTRACTORS.
(Blast Furnace Works.)
Rinehart, J. W., Cleveland, O.

MERCANTILE AGENCIES.
Iron & Steel Board of Trade, New York City.

METAL.
(Acid Proof.)
Keystone Bronze Co., Pittsburgh, Pa.

METAL COATING.
Metals Coating Co. of America, Chicago, Ill.

METALLURGISTS.
Hunt, Robert W., & Co., Chicago, Ill.
Steel Improvement Co., Cleveland, O.

METALLURGY OF IRON.
McLain's System, Inc., Milwaukee, Wis.

METALS.
Illinois Smelting & Refining Co., Chicago, Ill.

METALS.
(Non-Ferrous.)
American Manganese Bronze Co., Holmesburg, Philadelphia, Pa.
Blackwell, Geo. G., Sons & Co., Liverpool, England.
Lubricating Metal Co., The, New York City.
Titanium Alloy Mfg. Co., Niagara Falls, N. Y.

METAL SPECIALTIES.
White, L. & I. J., Co., Buffalo, N. Y.

MILL AND MINE SUPPLIES.
Dake Engine Co., Grand Haven, Mich.

MILLING MACHINES.
Cincinnati Milling Mach. Co., Cincinnati, O.
Espen-Lucas Machine Works, Philadelphia, Pa.
Newton Mch. Tool Wks., Inc., Philadelphia.
Niles-Bement-Pond Co., New York, N. Y.
Oliver Machinery Co., Grand Rapids, Mich.
Warner & Swasey Co., Cleveland, O.

MILLS.
(Blooming, Universal, Plate, Sheet, Tin, Bar.)
Mesta Machine Co., Pittsburgh, Pa.

MILL WEARING PARTS.
Midvale Steel Co., The, Philadelphia, Pa.

MINE SHAFT LINING.
(Concrete.)
Concrete Products Company, Pittsburgh, Pa.

MINING MACHINERY.
Link-Belt Company, Chicago, Ill.
McMyler Interstate Co., Cleveland, O.

MIXERS.
(Concrete.)
Blystone Mfg. Co., Cambridge Springs, Pa.
Standard Scale & Supply Co., Pittsburgh, Pa.

MIXERS.
(Sand.)
Blystone Mfg. Co., Cambridge Springs, Pa.

MOLDS.
(Ingot.)
Penn Mold & Mfg. Co., Wheeling, W. Va.

MOLDING MACHINES.
Arcade Mfg. Co., Freeport, Ill.
Pridmore, Henry E., Chicago, Ill.

MOLDINGS.
(Automobile.)
Empire Art Metal Co., College Pt., N. Y.

See Index to Advertisements for Pages Containing Advertisements of Companies Listed Above

CASTINGS

Malleable Iron

and Steel Castings

The National Malleable Castings Co.

Cleveland Chicago Indianapolis Toledo

Sharon, Pa. Melrose Park, Ill.

BAYONNE STEEL CASTING COMPANY

BAYONNE, N. J.

SAND BLAST CLEANED

CASTINGS

Quality, finish and service unsurpassed.

Acme Steel & Malleable Iron Works, Inc.

BUFFALO, N. Y.

Dayton Malleable Iron Co.

Dayton, Ohio

STEEL CASTINGS

CLEAN, SOUND AND TRUE TO PATTERN IN LOW AND MEDIUM CARBON AND MANGANESE STEEL

PROMPT SERVICE

ST. LOUIS STEEL FOUNDRY

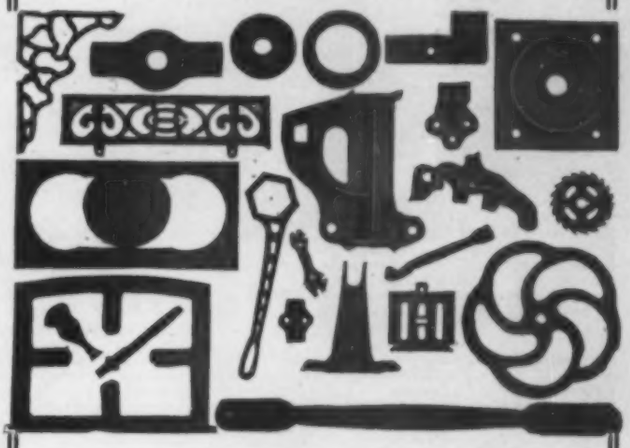
1501 Kienlen Avenue, - - - ST. LOUIS, Mo.

MALLEABLE IRON

CASTINGS

OF EVERY DESCRIPTION

Annual Capacity 25,000 Tons



Railroad and Stove Plate Malleables a Specialty

Prices furnished on receipt of Samples or Blue Prints

MISSOURI MALLEABLE IRON CO.

EAST ST. LOUIS, ILL.

ERIE MALLEABLE IRON COMPANY

ERIE, PA.

MONEL METAL.
Williams & Co., Pittsburgh, Pa.

MOTORS.
(Air.)
Dake Engine Co., Grand Haven, Mich.
Detroit Hoist & Machine Co., Detroit, Mich.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

MOTORS.
(Electric.)
Crocker-Wheeler Co., Ampere, N. J.
General Electric Co., Schenectady, N. Y.
Moore, Edgar M., & Co., Pittsburgh, Pa.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

MOTORS.
(Second Hand.)
Klein, Nathan, & Co., Inc., New York City.
Miller-Owen Electric Co., Pittsburgh, Pa.
Moore, Edgar M., & Co., Pittsburgh, Pa.
Pfannmueller Engineering Co., Chicago, Ill.

NAIL MACHINERY.
Kilby Mfg. Co., Cleveland, O.
National Machinery Co., Tiffin, O.
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

NAILS.
(Copper.)
American Steel & Wire Co., Chicago, Ill.

NAILS.
(Wire.)
American Steel & Wire Co., Chicago, Ill.
Cambria Steel Co., Philadelphia, Pa.
Jones & Laughlin Steel Co., Pittsburgh, Pa.
La Belle Iron Works, Steubenville, O.
Youngstown Sheet & Tube Co., Youngstown, O.

NAME PLATES.
(Cast, Bronze, Stamped and Etched.)
Matthews, Jas. H., & Co., Pittsburgh, Pa.

NUTS.
(See Bolts and Nuts.)

OIL CANS.
New Britain Machine Co., New Britain, Conn.

OPEN HEARTH FURNACES.
(See Furnaces—Open Hearth.)

ORDNANCE.
Midvale Steel Co., Philadelphia, Pa.

ORE.
(Chrome.)
Blackwell, Geo. G., Sons Co., Ltd., Liverpool, Eng.

ORE.
(Lead.)
Amer. Zinc, Lead & Smelt'g Co., New York.

ORE.
(Zinc.)
Amer. Zinc, Lead & Smelt'g Co., New York.

ORE DOCKS.
American Bridge Co., New York, N. Y.

OVENS.
(Coke, By-Product Recovery.)
Koppers, H., Co., Pittsburgh, Pa.

OVENS.
(Drying and Japanning.)
Young Brothers Company, Detroit, Mich.

OVENS.
(Wire Bluing.)
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

OXY-ACETYLENE WELDING AND CUTTING.
Linde Air Products Co., New York, N. Y.
Oxweld Acetylene Co., Chicago, Ill.
Prest-O-Lite Co., The, Indianapolis, Ind.

OXYGEN.
Linde Air Products Co., New York, N. Y.
Oxweld Acetylene Co., Chicago, Ill.

PACKING.
(Metallic.)
Lubricating Metal Co., The, New York, N. Y.

PACKINGS.
(Leather.)
Graton & Knight Mfg. Co., Worcester, Mass.
Williams, I. B., & Sons, Diver, N. H.

PANS.
(Lathe and Shop.)
American Bridge Co., New York, N. Y.
New Britain Mach. Co., New Britain, Conn.

PATTERNS.
(Wood and Metal.)
Acme Steel & Mall. Iron Wks., Inc., Buffalo.
American Metallic Pattern Co., Newark, N. J.
Arcade Mfg. Co., Freeport, Ill.
Buffalo Fdy. & Mch. Co., Buffalo, N. Y.
Buffalo Pattern Works, Buffalo, N. Y.
Empire Art Metal Co., College Pt., N. Y.
Newark Stamping & Fdy. Co., Newark, N. J.
Pridmore, Henry E., Chicago, Ill.
Wellman Pattern Supply Co., Cleveland, Ohio.

PATTERN SHOP EQUIPMENT.
Oliver Machinery Co., Grand Rapids, Mich.

PERFORATED METAL.
Erdle Perforating Co., Rochester, N. Y.
Hendrick Mfg. Co., Carbondale, Pa.

PIG IRON.
Baird & West, Detroit, Mich.
Bethlehem Steel Co., So. Bethlehem, Pa.
Bourne-Fuller Co., The, Cleveland, O.
Columbus Iron & Steel Co., Columbus, O.
Crocker Bros., New York, N. Y.
Davison, Allen S., Co., Pittsburgh, Pa.
Domhoff & Joyce Co., The, Cincinnati, O.
Eaton, Rhodes Co., Cincinnati, O.
Globe Iron Co., Jackson, O.
Hanna, M. A., & Co., Cleveland, O.
Hillman & Sons Co., J. H., Pittsburgh, Pa.
Illinois Steel Co., Chicago, Ill.
La Belle Iron Works, Steubenville, O.
McKeefrey & Co., Letonia, O.
Mitchell-Diggins Iron Co., Cadillac, Mich.
Mohr, J. J., & Son, Philadelphia, Pa.
Pickands, Mather & Co., Cleveland, O.
Republic Iron & Steel Co., Youngstown, O.
Rogers, Brown & Co., Cincinnati, O.
Semet-Solvay Co., Syracuse, N. Y.
Snyder, W. P., & Co., Pittsburgh, Pa.
Stewart Iron Co., Ltd., Cleveland, O.
Struthers Furnace Co., The, Cleveland, O.
Superior Charcoal Iron Co., Grand Rapids, Mich.
Tenn. Coal, Iron & Railroad Co., Birmingham, Ala.
Thomas Furnace Co., Milwaukee, Wis.
Upson Nut Co., Cleveland, O.
Wickwire Steel Co., Buffalo, N. Y.

PIG IRON BREAKERS.
Brown Hoisting Machinery Co., Cleveland, O.

PILE DRIVERS.
Industrial Works, Bay City, Mich.

PILING.
(Steel Sheet.)
Carnegie Steel Co., Pittsburgh, Pa.
Jones & Laughlin Steel Co., Pittsburgh, Pa.
Lackawanna Steel Co., Buffalo, N. Y.

PINIONS.
(See Gears.)

PINS.
American Vanadium Co., The, Pittsburgh, Pa.
Oliver Iron & Steel Co., Pittsburgh, Pa.

PIPE.
(Cast Iron.)
American Cast Iron Pipe Co., Birmingham, Ala.
Clow, James B., & Sons, Chicago, Ill.
Donaldson Iron Co., Emaus, Lehigh Co., Pa.
Glamorgan Pipe & Fdy. Co., Lynchburg, Va.
Lynchburg Fdy. Co., Lynchburg, Va.
Massillon Iron & Steel Co., Massillon, O.
Stand'd Cast Iron Pipe & Fdy. Co., Bristol, Pa.
U. S. Cast Iron Pipe & Fdy. Co., Philadelphia.

PIPE.
(Concrete Sewer and Culvert.)
Concrete Products Co., Pittsburgh, Pa.

PIPE.
(Iron and Steel.)
American Bridge Co., New York, N. Y.
American Steel Export Co., New York City.
Best Company, Pittsburgh, Pa.
Bourne-Fuller Co., The, Cleveland, O.
Buffalo Fdy. & Mach Co., Buffalo, N. Y.
Byers, A. M., Co., Pittsburgh, Pa.
Central Tube Co., Pittsburgh, Pa.
La Belle Iron Works, Steubenville, O.
Mark Mfg. Company, Evanston, Ill.
Pittsburgh Piping & Equip. Co., Pittsburgh.
Republic Iron & Steel Co., Youngstown, O.
Riter-Conley Mfg. Co., Pittsburgh, Pa.
U. S. Cast Iron Pipe and Fdy. Co., Burlington, N. J.
Youngstown Sheet & Tube Co., Youngstown, O.

PIPE.
(Steel.)
National Tube Co., Pittsburgh, Pa.

PIPE.
(Wrought Iron.)
Bourne-Fuller Co., The, Cleveland, O.
Byers, A. M., Co., Pittsburgh, Pa.
Pittsburgh Piping & Equip. Co., Pittsburgh, Pa.
Youngstown Sheet & Tube Co., Youngstown, O.

PIPE COVERING.
(Steam and Cold Water.)
Armstrong Cork & Insulation Co., Pittsburgh.

PIPE FITTINGS.
Best Company, Pittsburgh, Pa.
Illinois Malleable Iron Co., Chicago, Ill.
National Tube Co., Pittsburgh, Pa.
Pittsburgh Piping & Equip. Co., Pittsburgh.
Southwark Fdy. & Mach. Co., Pittsburgh, Pa.
United Engrg. & Fdy. Co., Pittsburgh, Pa.

PIPE MILL MACHINERY.
Landis Machine Co., Waynesboro, Pa.
Taylor-Wilson Mfg. Co., McKees Rocks, Pa.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
Williams Tool Co., Erie, Pa.

PIPE TAGS.
Matthews, Jas. H., & Co., Pittsburgh, Pa.

PIPE THREADING MACHINERY.
Standard Engrg. Co., Ellwood City, Pa.
Treadwell Engineering Co., Easton, Pa.

PIPING CONTRACTORS.
Best Company, Pittsburgh, Pa.
Pittsburgh Piping & Equip. Co., Pittsburgh.

PLANERS.
Cincinnati Planer Co., Cincinnati.
Cleveland Punch & Shear Works Co., Cleveland, O.
Manning, Maxwell & Moore, Inc., New York, N. Y.
Morton Mfg. Co., Muskegon Heights, Mich.
Newton Mch. Tool Works, Inc., Philadelphia.
Niles-Bement-Pond Co., New York, N. Y.

PLATES.
(Rolled Steel—Floor.)
Carnegie Steel Co., Pittsburgh, Pa.
Trussed Concrete Steel Co., Detroit, Mich.
Wood, Alan, Iron & Steel Co., Philadelphia.

PLATES.
(Sheared and Universal.)
Allegheny Steel Co., Pittsburgh, Pa.
American Rolling Mill Co., Middletown, O.
Belmont Iron Works, Philadelphia, Pa.
Bourne-Fuller Co., The, Cleveland, O.
Cambria Steel Co., Philadelphia, Pa.
Carnegie Steel Co., Pittsburgh, Pa.
Cincinnati Iron & Steel Co., Cincinnati, O.
Illinois Steel Co., Chicago, Ill.
Illinois Steel Co., Warehouse Dept., Chicago.
Illinois Steel Warehouse Co., St. Louis, Mo.
Illinois Steel Warehouse Co., St. Paul, Minn.
Inland Steel Co., Chicago, Ill.
La Belle Iron Works, Steubenville, O.
Lackawanna Steel Co., Buffalo, N. Y.
Otis Steel Co., Cleveland, O.
Republic Iron & Steel Co., Youngstown, O.
Ryerson, Jos. T., & Son, Chicago, Ill.
Tenn. Coal, Iron & Railroad Co., Birmingham, Ala.
Trussed Concrete Steel Co., Detroit, Mich.
Whitaker-Glessner Co., Portsmouth Works, Portsmouth, O.
Wood, Alan, Iron & Steel Co., Philadelphia.
Worth Bros. Co., Philadelphia, Pa.
Youngstown Sheet & Tube Co., Youngstown, O.

PLATES.
(Terne and Tin.)
American Sheet & Tin Plate Co., Pittsburgh.

PLATES.
(Vanadium Steel.)
American Vanadium Co., The, Pittsburgh, Pa.

POINTERS.
(Wire and Rod.)
Morgan Construction Co., Worcester, Mass.
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

POLE LINE HARDWARE.
(Plain or Galvanized.)
Michigan Bolt & Nut Works, Detroit, Mich.

POSTS.
(Steel Fence.)
American Steel & Wire Co., Chicago, Ill.

POTS.
(Lead and Cyanide.)
Blackwood Steel Fdy. Co., The, Springfield, O.

POULTRY NETTING.
American Steel & Wire Co., Chicago, Ill.

POWDERED COAL PLANTS.
Metal Production Equipment Co., Springfield, Mass.

POWER TOOLS.
Southwark Foundry & Mach. Co., Philadelphia.

POWER TRANSMITTING MACHINERY.
Birdsboro Steel Fdy. & Mch. Co., Birdsboro, Pa.
Link-Belt Company, Chicago, Ill.
Mesta Machine Co., Pittsburgh, Pa.
Treadwell Engineering Co., Easton, Pa.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

PRESSES.
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Bliss, E. W., Co., Brooklyn, N. Y.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cleveland Punch & Shear Works Co., Cleveland, O.
General Briquetting Co., New York City.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Mesta Machine Co., Pittsburgh, Pa.
Morgan Engineering Co., Alliance, O.
Niles-Bement-Pond Co., New York, N. Y.
Tod, Wm., Co., Youngstown, O.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
Wood, R. D., & Co., Philadelphia, Pa.

PRESSES.
(Bending and Flanging.)
Chambersburg Engrg. Co., Chambersburg, Pa.
Hydraulic Press Mfg. Co., Mount Gilead, O.
Mesta Machine Co., Pittsburgh, Pa.

PRESSES.
(Forging.)
Chambersburg Engrg. Co., Chambersburg, Pa.
Mesta Machine Co., Pittsburgh, Pa.
Tod, Wm., Co., Youngstown, O.
United Engrg. & Fdy. Co., Pittsburgh, Pa.

PRESSES.
(Hydraulic.)
Chambersburg Engrg. Co., Chambersburg, Pa.
Hydraulic Press Mfg. Co., Mt. Gilead, O.
Mesta Machine Co., Pittsburgh, Pa.
Niles-Bement-Pond Co., New York, N. Y.
Southwark Fdy. & Mch. Co., Philadelphia, Pa.
Tod, Wm., Co., Youngstown, O.
Treadwell Engineering Co., Easton, Pa.
United Engrg. & Fdy. Co., Pittsburgh, Pa.

PRESSES.
(Power.)
Toledo Machine & Tool Co., Toledo, O.

PRESSES.
(Rail Straightening.)
Tod, Wm., Co., Youngstown, O.

PRESSES.
(Toggle Drawing.)
Toledo Machine & Tool Co., Toledo, O.

PRESSES.
(Trimming.)
Erie Foundry Co., Erie, Pa.
Toledo Machine & Tool Co., Toledo, O.

PRESSURE GAGES.
Clark, Chas. J., Chicago, Ill.

PRESSURE REGULATORS.
Connersville Blower Co., The, Connersville, Ind.
Electric Controller & Mfg. Co., Cleveland, O.

See Index to Advertisements for Pages Containing Advertisements of Companies Listed Above

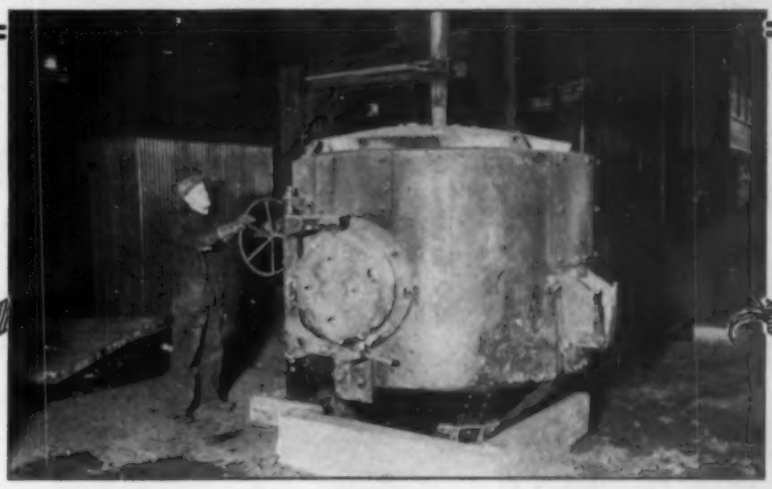
CASTINGS

STEEL CASTINGS

Open Hearth and Electric
Nine Plants at Your Service

AMERICAN STEEL FOUNDRIES
New York Chicago Pittsburgh

THE MARK OF QUALITY SIVYER S STEEL



THE MARK OF QUALITY SIVYER S STEEL

Sivyer Quality Electric Furnace Steel Castings

The superior physical properties of Sivyer Electric Furnace Steel—its strength, toughness, resistance to crystallization, make it the ideal steel for use where quality and service are paramount.

What's more, machine molded, carefully annealed, sand-blasted and tumbled, Sivyer Castings will reduce your machining costs and eliminate a large percentage of your spoilage.

Make us prove it on a trial order

SIVYER STEEL CASTING COMPANY

MILWAUKEE, WIS.

Electric Furnace and Tropenas Converter Steel. Vanadium and other Alloy Steel castings. Case-hardening, tempering and special carbon cast steels. Cast steel die blocks.

SMALL STEEL CASTINGS

OF QUALITY

Farrell-Cheek Steel Foundry Co.
Sandusky, Ohio

LIGHT STEEL CASTINGS

REED FOUNDRY AND MACHINE CO.
KALAMAZOO, MICHIGAN

PROJECTILES.
Midvale Steel Co., Philadelphia, Pa.
PULLEYS.
Excelsior Pulley Co., The, Cuba, N. Y.
PULLEYS.
(Wood-Split.)
Excelsior Pulley Co., The, Cuba, N. Y.
PULVERIZING MILLS.
Lehigh Car, Wheel & Axle Works, Catasauqua, Pa.
Williams Patent Crusher & Pulverizer Co., Chicago, Ill.
PUMPS.
Aldrich Pump Co., Allentown, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Connersville Blower Co., The, Connersville, Ind.
Dake Engine Co., Grand Haven, Mich.
Dean Bros. Steam Pump Works, Indianapolis, Ind.
Deming Co., Salem, O.
Gilbert & Barker Mfg. Co., Springfield, Mass.
Hydraulic Press Mfg. Co., Mount Gilead, O.
Reilly, J. J., Mfg. Co., Louisville, Ky.
Roots, P. H. & F. M., Co., Connersville, Ind.
Standard Scale & Supply Co., Pittsburgh, Pa.
Tod, Wm., Co., Youngstown, O.
Vulcan Iron Works, Wilkesbarre, Pa.
PUMPS.
(Boiler and Feed.)
Reilly, J. J., Mfg. Co., Louisville, Ky.
PUMPS.
(By-Products.)
Dean Bros. Steam Pump Works, Indianapolis.
PUMPS.
(Gas, Rotary Positive Pressure.)
Connersville Blower Co., The, Connersville, Ind.
Roots, P. H. & F. M., Co., Connersville, Ind.
PUMPS.
(Vacuum.)
Buffalo Fdy. & Machine Co., Buffalo, N. Y.
Connersville Blower Co., The, Connersville, Ind.
Dean Bros. Steam Pump Works, Indianapolis.
Deming Co., Salem, O.
Mesta Machine Co., Pittsburgh, Pa.
Roots, P. H. & F. M., Co., Connersville, Ind.
PUNCHES.
(Hydraulic.)
Mesta Machine Co., Pittsburgh, Pa.
PUNCHING AND SHEARING MACHINERY.
Allen, John F., Co., New York, N. Y.
Alliance Machine Co., Alliance, O.
Bellefonte Engrg. Works, Bellefonte, Pa.
Bertsch & Co., Cambridge City, Ind.
Bliss, E. W., Co., Brooklyn, N. Y.
Bourne-Fuller Co., The, Cleveland, O.
Cleveland Punch & Shear Works Co., Cleveland, O.
Erie Foundry Co., Erie, Pa.
Hilles & Jones, Wilmington, Del.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Mesta Machine Co., Pittsburgh, Pa.
Morgan Engineering Co., Alliance, O.
Niles-Bement-Pond Co., New York, N. Y.
Richards, I. T., Providence, R. I.
Ryerson, Jos. T., & Son, Chicago, Ill.
Scully Steel & Iron Co., Chicago, Ill.
Standard Bridge Tool Co., Pittsburgh, Pa.
Tod, Wm., Co., Youngstown, O.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
Wickes Brothers, Saginaw, Mich.
Wood, R. D., & Co., Philadelphia, Pa.
PUSH BUTTONS.
Electric Controller & Mfg. Co., Cleveland, O.
PYROMETERS.
Stupakoff Laboratories, Pittsburgh, Pa.
Thwing Instrument Co., Philadelphia, Pa.
RACKS.
(Steel or Tool.)
Angle Steel Stool Co., Otsego, Mich.
Empire Art Metal Co., Inc., College Pt., N. Y.
New Britain Mach. Co., New Britain, Conn.
RAIL BONDS.
American Steel & Wire Co., Chicago, Ill.
RAIL JOINTS.
Carnegie Steel Co., Pittsburgh, Pa.
Lackawanna Steel Co., Buffalo, N. Y.
RAILROAD EQUIPMENT.
(Industrial.)
Lakewood Engrg. Co., Cleveland, O.
RAILROAD SUPPLIES.
American Steel Export Co., New York City.
Sherwood, E. C., New York City.
U. S. Metal & Mfg. Co., New York City
Zelnicker, Walter A., Supply Co., St. Louis, Mo.
RAILS.
American Steel Export Co., New York City.
Bethlehem Steel Co., The, South Bethlehem, Pa.
Cambria Steel Co., Johnstown, Pa.
Carnegie Steel Co., Pittsburgh, Pa.
Illinois Steel Co., Chicago, Ill.
Jones & Laughlin Steel Co., Pittsburgh, Pa.
Lackawanna Steel Co., Buffalo, N. Y.
Sherwood, E. C., New York City.
Tenn. Coal, Iron & R. R. Co., Birmingham, Ala.
RAILS.
(Girder.)
Bethlehem Steel Co., The, South Bethlehem, Pa.
RAILS.
(High Tee.)
Bethlehem Steel Co., The, South Bethlehem, Pa.
REAMERS.
(Bridge.)
Latrobe Tool Co., The, Latrobe, Pa.
RECORDERS.
Thwing Instrument Co., Philadelphia, Pa.
REELS.
(Solid and Adjustable.)
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.
REGULATORS.
(Automatic Pressure.)
Cutler-Hammer Mfg. Co., Milwaukee, Wis.
RELAYS.
(Pressure and Vacuum.)
Cutler-Hammer Mfg. Co., Milwaukee, Wis.
RHEOSTATS.
Cutler-Hammer Mfg. Co., Milwaukee, Wis.
Electric Controller & Mfg. Co., Cleveland, O.
RINGS.
(Steel and Forged.)
Akron-Selle Co., The, Akron, O.
RINGS.
(Steel, Weldless.)
Camden Forge Co., The, Camden, N. J.
RIVETERS.
(Hydraulic.)
Hanna Engineering Works, Chicago, Ill.
Southwark Fdy. & Mch. Co., Philadelphia, Pa.
Wood, R. D., & Co., Philadelphia, Pa.
RIVETING MACHINERY.
Allen, John F., Co., New York, N. Y.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cleveland Pneumatic Tool Co., Cleveland, O.
Hanna Engineering Works, Chicago, Ill.
Oldham, Geo., & Sons Co., Frankfort, Phipadelphia, Pa.
RIVETS.
American Iron & Steel Mfg. Co., Lebanon, Pa.
American Vanadium Co., The, Pittsburgh, Pa.
Bourne-Fuller Co., The, Cleveland, O.
Illinois Steel Co., Warehouse Dept., Chicago, Ill.
Illinois Steel Warehouse Co., St. Louis, Mo.
Illinois Steel Warehouse Co., St. Paul, Minn.
Inland Steel Co., Chicago, Ill.
Lockhart Iron & Steel Co., Pittsburgh, Pa.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Oliver Iron & Steel Co., Pittsburgh, Pa.
Progressive Mfg. Co., Torrington, Conn.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Ryerson, Jos. T., & Son, Chicago, Ill.
Scully Steel & Iron Co., Chicago, Ill.
Upson Nut Co., Cleveland, O.
ROAD GUARD FENCE.
(Concrete.)
Concrete Products Co., Pittsburgh, Pa.
RODS.
(Brass, Bronze and Aluminum.)
Gardner, B. M., Company, Cleveland, O.
RODS.
(Connecting.)
Camden Forge Co., Camden, N. J.
Leard, Wm. E., New Brighton, Pa.
RODS.
(Drill.)
Bourne-Fuller Co., The, Cleveland, O.
RODS.
(Iron and Steel.)
American Iron & Steel Mfg. Co., Lebanon, Pa.
American Steel & Wire Co., Chicago, Ill.
American Steel Export Co., New York City.
Bethlehem Steel Co., South Bethlehem Pa.
Upson Nut Co., Cleveland, O.
Youngstown Sheet & Tube Co., Youngstown, O.
ROLL GRINDING MACHINES.
Norton Grinding Co., Worcester, Mass.
ROLLING MILL EQUIPMENT.
Abramsen Engrg. Co., Pittsburgh, Pa.
Alliance Machine Co., Alliance, O.
Blake & Johnson Co., Waterbury, Conn.
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Farrel Fundry & Machine Co., Ansonia, Conn.
Fawcus Machine Co., Pittsburgh, Pa.
Garrison, A., Foundry Co., Pittsburgh, Pa.
Hilles & Jones, Wilmington, Del.
Hyde Park Fdy. & Mch. Co., Hyde Park, Pa.
Hubbard Steel Fdy. Co., E. Chicago, Ind.
Industrial Works, Bay City, Mich.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Mesta Machine Co., Pittsburgh, Pa.
Morgan Engineering Co., Alliance, O.
Morgan Construction Co., Worcester, Mass.
Newbold, R. S., & Son Co., Norristown, Pa.
Standard Engineering Co., Ellwood City, Pa.
Tod, Wm., Co., Youngstown, O.
Treadwell Engineering Co., Easton, Pa.
Wellman-Seaver-Morgan Co., Cleveland, O.
Wheeling Mold & Fdy. Co., Pittsburgh, Pa.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
Youngstown Fdy. & Mch. Co., Youngstown, O.
ROLLS.
Camden Forge Co., Camden, N. J.
Pittsburgh Iron & Steel Foundries Co., Pittsburgh, Pa.
ROLLS.
(Adamite.)
Pittsburgh Iron & Steel Foundries Co., Pittsburgh, Pa.
ROLLS.
(Bending and Straightening.)
Bertsch & Co., Cambridge City, Ind.
Hilles & Jones, Wilmington, Del.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
ROLLS.
(Sand Chilled and Steel.)
American Steel Foundries, Chicago, Ill.
Bethlehem Steel Co., So. Bethlehem, Pa.
Birdsboro Steel Foundry & Machine Co., Birdsboro, Pa.
Farrell Fdy. & Mach. Co., Ansonia, Conn.
Garrison, A., Foundry Co., Pittsburgh, Pa.
Hubbard Steel Fdy. Co., E. Chicago, Ind.
Hyde Park Fdy. & Mch. Co., Hyde Park, Pa.
Mesta Machine Co., Pittsburgh, Pa.
National Roll & Foundry Co., Avonmore, Pa.
Pittsburgh Iron & Steel Foundries Co., Pittsburgh, Pa.
Seaman, Sleeth & Co., Pittsburgh, Pa.
Standard Engrg. Co., Ellwood City, Pa.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
Youngstown Fdy. & Mach. Co., Youngstown, O.
ROLLS.
(Wood.)
Dart, E. M., Mfg. Co., Providence, R. I.
ROOFING AND SIDING.
(Composite.)
American Sheet & Tin Plate Co., Pittsburgh.
Texas Company, The, New York City.
ROOFING AND SIDING.
(Iron and Steel.)
American Rolling Mill Co., Middletown, O.
American Sheet & Tin Plate Co., Pittsburgh.
Brier Hill Steel Co., Youngstown, O.
Canton Sheet Steel Co., Canton, O.
La Belle Iron Works, Youngstown, O.
Ryerson, Jos. T., & Son, Chicago, Ill.
Seneca Iron & Steel Co., Buffalo, N. Y.
Stark Rolling Mill Co., Canton, O.
Western Reserve Steel Co., Warren, O.
Whitaker-Glessner Co., Portsmouth, Works, Portsmouth, O.
Wood, Alan, Iron & Steel Co., Philadelphia.
Youngstown Iron & Steel Co., Youngstown, O.
Youngstown Sheet & Tube Co., Youngstown, O.
ROPE DRESSING.
Texas Company, The, New York City.
RUNNING GEAR WHEELS, AXLES AND BEARINGS.
Lakewood Engrg. Co., Cleveland, O.
RUSTPROOFING.
Metals Coating Co. of America, Chicago, Ill.
SAFE ENDS.
(Boiler Tube.)
Worth Brothers Co., Philadelphia, Pa.
SAND.
(Molding.)
Gordon Sand Co., Inc., The, Conneaut, O.
Standard Sand & Machine Co., Cleveland, O.
SAND BLAST.
(Shot.)
Globe Steel Co., Mansfield, O.
SAND BLAST EQUIPMENT AND ACCESSORIES.
American Foundry Equipment Co., New York City.
Pangborn Corporation, Hagerstown, Md.
SAND BLAST ROOMS WITH REVOLVING TABLES.
American Foundry Equipment Co., New York City.
Pangborn Corporation, Hagerstown, Md.
SAND BLAST TUMBLING BARRELS.
American Foundry Equipment Co., New York City.
SAND CONVEYING AND HANDLING MACHINERY.
Link-Belt Company, Chicago, Ill.
Standard Sand & Machine Co., Cleveland, O.
SAND CUTTING MACHINERY.
American Foundry Equipment Co., New York City.
SAND MIXING MACHINERY.
Blystone Mfg. Co., Cambridge Springs, Pa.
Standard Sand & Machine Co., Cleveland, O.
SAND SIFTERS.
Arcade Mfg. Co., Freeport, Ill.
Standard Sand & Machine Co., Cleveland, O.
Whiting Fdy. & Equip. Co., Harvey, Ill.
SASH.
(Steel Casement.)
Trussed Concrete Steel Co., Detroit, Mich.
SAW ARBORS.
Camden Forge Co., Camden, N. J.
SAWS.
(Cold and Hot Metal.)
Disston, Henry & Sons, Inc., Philadelphia, Pa.
Espen-Lucas Mch. Works, Philadelphia, Pa.
Hunter Saw & Machine Co., Pittsburgh, Pa.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Newton Mach. Tool Works, Inc., Philadelphia, Pa.
O. M. S. Company, The, Chicago, Ill.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
SAWS.
(Hack.)
Disston, Henry & Sons, Inc., Philadelphia, Pa.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Mesta Machine Co., Pittsburgh, Pa.
Peerless Machine Co., Racine, Wis.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
SAWS.
(Inserted Tooth.)
Hunter Saw & Mch. Co., Pittsburgh, Pa.
SAW SHARPENING MACHINERY.
Disston, Henry, & Sons, Inc., Philadelphia, Pa.
SCALES.
(Automatic Dial.)
Standard Scale & Supply Co., Pittsburgh, Pa.
SCALES.
(Automobile.)
Standard Scale & Supply Co., Pittsburgh, Pa.
SCALES.
(Hopper)
Standard Scale & Supply Co., Pittsburgh, Pa.

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CASTINGS

Wheeling Mold and Foundry Co.
WHEELING, WEST VIRGINIA
Rolls Chilled, Sand and Steel — Acid Open Hearth **Steel Castings** — Rolling Mill Machinery
Pittsburgh Office, Farmers Bank Building

THE DAYTON STEEL FOUNDRY CO.
Quality — HIGH GRADE STEEL CASTINGS AUTOMOBILE CASTINGS A SPECIALTY — Service
DAYTON, OHIO.

Malleable Iron Castings
Quality and Service
The Danville Malleable Iron Company
DANVILLE, ILLINOIS

National Foundry Co.
NF
ACID OPEN HEARTH
STEEL CASTINGS
Also Gray Iron Castings
ERIE, PA.

ELECTRIC
Steel Castings
greater tensile strength—higher elastic ratio—higher static value—purer chemically—made under superior refining conditions.
"TREADWELL means SERVICE"
We also specialize GRAY IRON CASTINGS; MACHINERY—designed for special purposes; "STOEVER" PIPE THREADING MACHINES; HYDRAULIC MACHINERY; ROLLING MILL EQUIPMENT, etc.
Treadwell Engineering Company
EASTON, PENNA.
NEW YORK PHILADELPHIA CHICAGO

Strong Steel Foundry Co.
Manufacturers of
Acid Open Hearth Steel Castings
of Finest Quality
From 1 Pound to 20,000 Pounds

Also Manufacturers of
Manganese Steel Castings
Small Steel Castings in Large Quantities at Extremely Low Prices
You want the best, send us your drawings for estimate
Office and Works 33 Norris Street — Buffalo, New York

The Marshall Foundry Company
Pittsburgh, Pa.
Ingot Molds — Gray Iron Castings
Capacity 600 Tons per day

CASTINGS
FINE LIGHT GRAY IRON
North Buffalo Hardware Foundry
BUFFALO, N. Y.

Gray Iron and Converter Steel
CASTINGS
with a name behind them that guarantees their quality.
ADAMSON'S is always suggested when a *better* quality of castings is desired.
Because of its large, compiete modern plant, the ADAMSON COMPANY is able to handle any order for Converter Steel castings up to 2500 pounds, and anything in Gray Iron castings up to 10 tons.
Send us your sketches or blueprints.
The Adamson Machine Co.
AKRON, OHIO

SCALES.
(Railroad.)
Standard Scale & Supply Co., Pittsburgh, Pa.

SCALES.
(Track.)
Standard Scale & Supply Co., Pittsburgh, Pa.

SCRAP RECLAIMING EQUIPMENT.
Southwark Foundry & Mach. Co., Philadelphia.

SCALES, CARS AND BOXES.
Lakewood Engrg. Co., Cleveland, O.

SCREENS.
Hendrick Mfg. Co., Carbondale, Pa.
Link-Belt Company, Chicago, Ill.
Standard Scale & Supply Co., Pittsburgh, Pa.

SCREENS.
(Coal and Sand.)
Link-Belt Company, Chicago, Ill.
Standard Sand & Machine Co., Cleveland, O.
Wright Wire Co., Worcester, Mass.

SCREENS.
(Pulsating and Revolving.)
Chalmers & Williams, Chicago Heights, Ill.
Link-Belt Company, Chicago, Ill.

SCREENS.
(Water Intake.)
Link-Belt Company, Chicago, Ill.

SCREW MACHINE PRODUCTS.
(Special.)
Acme Mfg. Co., Boonton, N. J.
Standard Screw Products Co., Detroit, Mich.

SCREW MACHINES.
(Hand.)
Oliver Machinery Co., Grand Rapids, Mich.

SCREWS.
American Iron & Steel Mfg. Co., Lebanon, Pa.
Clark Bros., Bolt Co., Milldale, Conn.
Milton Mfg. Co., Milton, Pa.
Progressive Mfg. Co., Torrington, Conn.
Republic Iron & Steel Co., Youngstown, O.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.

SCREW STOCK.
(Free Cutting.)
Columbia Steel & Shafting Co., Pittsburgh, Pa.

SCREW STOCK.
(Iron.)
Westerman & Co., Lockport, N. Y.

SECOND HAND MACHINERY.
Baird Machy Co., Pittsburgh, Pa.
Bosworth, W. H., Cleveland, O.
Moore, Edgar M., & Co., Pittsburgh, Pa.
Niles-Bement-Pond Co., New York, N. Y.
Pfannmueller Engineering Co., Chicago, Ill.
Ryerson, Jos. T., & Son, Chicago, Ill.
Sherwood, E. C., New York City.
Zelnicker, Walter A., Supply Co., St. Louis, Mo.

SEPARATORS—SAW DUST.
(Nail.)
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

SET AND CAP SCREW IRON.
Westerman & Co., Lockport, N. Y.

SHAFT HANGERS.
New Departure Mfg. Co., Bristol, Conn.

SHAFTING.
American Vanadium Co., The, Pittsburgh, Pa.
Bethlehem Steel Co., So. Bethlehem, Pa.
Bourne-Fuller Co., The, Cleveland, O.
Camden Forge Co., Camden, N. J.
Cincinnati Iron & Steel Co., Cincinnati, O.
Columbia Steel & Shafting Co., Pittsburgh, Pa.
Cumberland Steel Co., Cumberland, Md.
Jones & Laughlin Steel Co., Pittsburgh, Pa.
National Tube Co., Pittsburgh, Pa.
Republic Iron & Steel Co., Youngstown, O.
Ryerson, Jos. T., & Sons, Chicago, Ill.
Scully Steel & Iron Co., Chicago, Ill.
Standard Gauge Steel Co., Beaver Falls, Pa.
Union Drawn Steel Co., Beaver Falls, Pa.

SHAFTING.
(Turned and Polished.)
Bourne-Fuller Co., The, Cleveland, O.

SHAFTING MACHINERY.
Ward's, Edgar T., Sons, Boston, Mass.

SHAPERS.
Cleveland Punch & Shear Works Co., Cleveland, O.
Manning, Maxwell & Moore, Inc., New York, N. Y.
Morton Mfg. Co., Muskegon Heights, Mich.
Newton Mach. Tool Wks., Inc., Philadelphia.
Niles-Bement-Pond Co., New York, N. Y.

SHAPES.
(Special, Hollow Metal.)
Empire Art Metal Co., Inc., College Pt., N. Y.

SHAPES.
(Iron and Steel.)
American Vanadium Co., The, Pittsburgh, Pa.
Belmont Iron Works, Philadelphia, Pa.
Bourne-Fuller Co., The, Cleveland, O.
Carnegie Steel Co., Pittsburgh, Pa.
Columbia Steel & Shafting Co., Pittsburgh, Pa.
Empire Art Metal Co., Inc., College Pt., N. Y.
Illinois Steel Co., Chicago, Ill.
Laclede Steel Co., St. Louis, Mo.
Moltrup Steel Products Co., Beaver Falls, Pa.
Republic Iron & Steel Co., Youngstown, O.
Scully Steel & Iron Co., Chicago, Ill.

SHAPES.
(Wire, Flat and Round.)
Cuyahoga Spring Co., Cleveland, O.

SHEAR BLADES AND KNIVES.
Tinker, F., & Sons Co., Pittsburgh, Pa.
White, L. & I. J., Co., Buffalo, N. Y.

SHEARS.
(Alligator.)
Youngstown Fdy. & Mch. Co., Youngstown, O.

SHEARS.
(Angle and Plate.)
Bertsch & Co., Cambridge City, Ind.
Bliss, E. W., Co., Brooklyn, N. Y.
Erie Foundry Co., Erie, Pa.
Garrison, A., Foundry Co., Pittsburgh, Pa.
Hilles & Jones, Wilmington, Del.
Mesta Machine Co., Pittsburgh, Pa.
Tod, Wm., Co., Youngstown, O.
Toledo Machine & Tool Co., Toledo, O.
United Engrg. & Fdy. Co., Pittsburgh, Pa.

SHEARS.
(Billet, Bloom and Slab.)
Garrison, A., Foundry Co., Pittsburgh, Pa.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Tod, Wm., Co., Youngstown, O.
United Engrg. & Fdy. Co., Pittsburgh, Pa.

SHEARS.
(Flying and Bar.)
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Morgan Construction Co., Worcester, Mass.

SHEARS.
(Lever.)
Mesta Machine Co., Pittsburgh, Pa.
United Engrg. & Fdy. Co., Pittsburgh, Pa.
Youngstown Fdy. & Mch. Co., Youngstown, O.

SHEARS.
(Scrap Wire.)
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

SHEET BARS.
Carnegie Steel Co., Pittsburgh, Pa.
Central Steel Co., The, Massillon, O.
Illinois Steel Co., Chicago, Ill.
La Belle Iron Works, Steubenville, O.
Lackawanna Steel Co., Buffalo, N. Y.
Republic Iron & Steel Co., Youngstown, O.
Tenn. Coal, Iron & R. R. Co., Birmingham, Ala.
Youngstown Iron & Steel Co., Youngstown, O.

SHEETS.
Allegheny Steel Co., Pittsburgh, Pa.
American Rolling Mill Co., Middletown, O.
American Sheet & Tin Plate Co., Pittsburgh.
American Vanadium Co., The, Pittsburgh, Pa.
Bourne-Fuller Co., The, Cleveland, O.
Canton Sheet Steel Co., Canton, O.
Disston & Sons, Inc., Henry, Philadelphia, Pa.
Erdle Perforating Co., Rochester, N. Y.
Illinois Steel Co., Chicago, Ill.
Illinois Steel Co., Warehouse Dept., Chicago, Ill.
Illinois Steel Warehouse Co., St. Louis, Mo.
Illinois Steel Warehouse Co., St. Paul, Minn.
Inland Steel Co., The, Chicago, Ill.
La Belle Iron Works, Steubenville, O.
Mansfield Sheet & Tin Plate Co., Mansfield, O.
Republic Iron & Steel Co., Youngstown, O.
Ryerson, Jos. T., & Son, Chicago, Ill.
Scully Steel & Iron Co., Chicago, Ill.
Seneca Iron & Steel Co., Buffalo, N. Y.
Stark Rolling Mill Co., Canton, O.
Tenn. Coal, Iron & R. R. Co., Birmingham, Ala.
Trumbull Steel Co., Warren, O.
Whitaker-Glessner Co., Portsmouth Works, Portsmouth, O.
Wood, Alan, Iron & Steel Co., Philadelphia.
Youngstown Sheet & Tube Co., Youngstown, O.

SHEETS.
(Black.)
American Sheet & Tin Plate Co., Pittsburgh.
Bourne-Fuller Co., The, Cleveland O.
Brier Hill Steel Co., Youngstown, O.
Canton Sheet Steel Co., Canton, O.
Cincinnati Iron & Steel Co., Cincinnati, O.
Inland Steel Co., Chicago, Ill.
La Belle Iron Works, Steubenville, O.
Mansfield Sheet & Tin Plate Co., Mansfield, O.
Ryerson, Joseph T., & Son, Chicago, Ill.
Seneca Iron & Steel Co., Buffalo, N. Y.
Stark Rolling Mill Co., Canton, O.
Western Reserve Steel Co., Warren, O.
Whitaker-Glessner Co., Portsmouth Works, Portsmouth, O.
Youngstown Iron & Steel Co., Youngstown, O.
Youngstown Sheet & Tube Co., Youngstown, O.

SHEETS.
(Blue Annealed.)
American Rolling Mill Co., Middletown, O.
American Sheet & Tin Plate Co., Pittsburgh.
Bourne-Fuller Co., The, Cleveland, O.
Canton Sheet Steel Co., Canton, O.
Cincinnati Iron & Steel Co., Cincinnati, O.
La Belle Iron Works, Steubenville, O.
Ryerson, Jos. T., & Son, Chicago, Ill.
Seneca Iron & Steel Co., Buffalo, N. Y.
Stark Rolling Mill Co., Canton, O.
Western Reserve Steel Co., Warren, O.
Whitaker-Glessner Co., Portsmouth Works, Portsmouth, O.
Youngstown Sheet & Tube Co., Youngstown, O.

SHEETS.
(Brass and Copper.)
Gardner, B. M., Company, Cleveland, O.

SHEETS.
(Cold Rolled.)
Bourne-Fuller Co., The, Cleveland, O.
Inland Steel Co., Chicago, Ill.
Stark Rolling Mill Co., Canton, O.
Western Reserve Steel Co., Warren, O.
Youngstown Sheet & Tube Co., Youngstown, O.

SHEETS.
(Corrugated.)
American Rolling Mill Co., Middletown, O.
American Sheet & Tin Plate Co., Pittsburgh.
Bourne-Fuller Co., The, Cleveland, O.
Brier Hill Steel Co., Youngstown, O.
Canton Sheet Steel Co., Canton, O.
Cincinnati Iron & Steel Co., Cincinnati, O.
Inland Steel Co., Chicago, Ill.
La Belle Iron Works, Steubenville, O.
Ryerson, Joseph T., & Son, Chicago, Ill.
Seneca Iron & Steel Co., Buffalo, N. Y.
Stark Rolling Mill Co., Canton, O.
Tenn. Coal, Iron & R. R. Co., Birmingham, Ala.
Trumbull Steel Co., Warren, O.
Whitaker-Glessner Co., Portsmouth Works, Portsmouth, O.
Youngstown Iron & Steel Co., Youngstown, O.
Youngstown Sheet & Tube Co., Youngstown, O.

SHEETS.
(Dead Soft.)
American Rolling Mill Co., Middletown, O.
American Sheet & Tin Plate Co., Pittsburgh.
Bourne-Fuller Co., The, Cleveland, O.
Canton Sheet Steel Co., Canton, O.
La Belle Iron Works, Steubenville, O.
Mansfield Sheet & Tin Plate Co., Mansfield, O.
Seneca Iron & Steel Co., Buffalo, N. Y.
Stark Rolling Mill Co., Canton, O.
Ward's Edgar T., Sons, Boston, Mass.
Western Reserve Steel Co., Warren, O.
Whitaker-Glessner Co., Portsmouth Works, Portsmouth, O.
Youngstown Iron & Steel Co., Youngstown, O.
Youngstown Sheet & Tube Co., Youngstown, O.

SHEETS.
(Galvanized.)
Allegheny Steel Co., Pittsburgh, Pa.
American Sheet & Tin Plate Co., Pittsburgh.
Bourne-Fuller Co., The, Cleveland, O.
Brier Hill Steel Co., Youngstown, O.
Canton Sheet Steel Co., Canton, O.
Inland Steel Co., Chicago, Ill.
La Belle Iron Works, Steubenville, O.
Republic Iron & Steel Co., Youngstown, O.
Ryerson, Jos. T., & Son, Chicago, Ill.
Seneca Iron & Steel Co., Buffalo, N. Y.
Stark Rolling Mill Co., Canton, O.
Trumbull Steel Co., Warren, O.
Western Reserve Steel Co., Warren, O.
Whitaker-Glessner Co., Portsmouth Works, Portsmouth, O.
Wood, Alan, Iron & Steel Co., Philadelphia.
Youngstown Iron & Steel Co., Youngstown, O.
Youngstown Sheet & Tube Co., Youngstown, O.

SHEETS.
(Long Terne.)
Canton Sheet Steel Co., Canton, O.

SHEETS.
(Polishing and Planished.)
American Rolling Mill Co., Middletown, O.
Bourne-Fuller Co., The, Cleveland, O.
Mansfield Sheet & Tin Plate Co., Mansfield, O.

SHEETS.
(Roofing.)
(See Roofing and Siding.)

SHEET IRON WORK.
Hendrick Mfg. Co., Carbondale, Pa.

SHEET METAL WORKING MACHINERY.
Bliss, E. W., Co., Brooklyn, N. Y.

SHELVING.
(Steel.)
Empire Art Metal Co., Inc., College Pt., N. Y.
New Britain Mach. Co., New Britain, Conn.

SHINGLES.
(Galvanized and Terne Painted.)
Canton Sheet Steel Co., Canton, O.

SHOP BOXES AND CANS.
New Britain Machine Co., New Britain, Conn.

SIGNS.
(Metal.)
Beecher-Fowler Mfg. Co., Louisville, Ky.

SLABS.
American Steel Export Co., New York City.
La Belle Iron Works, Steubenville, O.
Lackawanna Steel Co., Buffalo, N. Y.
Tenn. Coal, Iron & R. R. Co., Birmingham, Ala.
Whitaker-Glessner Co., Portsmouth Works, Portsmouth, O.
Youngstown Sheet & Tube Co., Youngstown, O.

SLEEVES AND NOZZLES.
Manown Mfg. Co., Pittsburgh, Pa.

SOFT BESSEMER SQUARES.
Witherow Steel Co., Pittsburgh, Pa.

SPECIAL MACHINERY.
Marvin & Casler Co., Canastota, N. Y.

SPECIAL SHAPE WIRE.
Roebling's, John A., Sons Co., Trenton, N. J.

SPELTER.
Amer. Zinc, Lead & Smelt'g Co., New York.

SPIKES.
American Iron & Steel Mfg. Co., Lebanon, Pa.
American Steel & Wire Co., Chicago, Ill.
Illinois Steel Co., Chicago, Ill.
Inland Steel Co., Chicago, Ill.
Republic Iron & Steel Co., Youngstown, O.

SPOKE WIRE FOR WIRE WHEELS.
American Steel & Wire Co., Chicago, Ill.

SPRINGS.
American Steel & Wire Co., Chicago, Ill.
American Vanadium Co., Pittsburgh, Pa.
Cuyahoga Spring Co., Cleveland, O.
Duer Spring & Mfg. Co., Pittsburgh, Pa.
Raymond Mfg. Co., Corry, Pa.

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CASTINGS

PITTSBURGH MALLEABLE IRON CO.
MALLEABLE CASTINGS
Pittsburgh, Penna.

ZANESVILLE MALLEABLE CO.
MALLEABLE CASTINGS
ZANESVILLE, OHIO

MALLEABLE CASTINGS
CM
We positively guarantee Quality and Deliveries
THE COLUMBUS MALLEABLE IRON CO.
COLUMBUS, OHIO

Belle City Malleable Iron Co.
MALLEABLE IRON
CASTINGS
RACINE, WISCONSIN

General Machine and Pattern Work
BRASS BRONZE **CASTINGS** GRAY IRON
BELLEFONTE ENGINEERING CO.
Manufacturers Power Hammers, Shears, Punches and Presses
BELLEFONTE, PA.

Atlas Steel Casting Company
General Office and Works:
BUFFALO, N. Y.
Acid Open Hearth Steel Castings Exclusively
Frank D. Moffat & Co., New York and New England
Sales Agents, 81 Fulton Street, New York

THE MARION MALLEABLE IRON WORKS
MARION, INDIANA
MALLEABLE CASTINGS
for General Purposes

Automobile Castings
The Allyne-Ryan Foundry Co.
CLEVELAND

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Meadville, Pa.

SPROCKET AND TRACTION WHEELS.
Lehigh Car, Wheel & Axle Works, Catasauqua, Pa.

SQUARES.
(Soft Bessemer.)
Witherow Steel Co., Pittsburgh, Pa.

SQUEEZER.
(Power.)
Pridmore, Henry E., Chicago, Ill.

SQUEEZER MOLDING MACHINES.
Pridmore, Henry E., Chicago, Ill.

STACKS.
(Steel.)
American Bridge Co., New York, N. Y.
Phoenix Iron Works Co., Meadville, Pa.

STAMPINGS.
(Sheet Metal.)
Bettcher Mfg. Co., Cleveland, O.
Dodd, Theo. L., Chicago, Ill.
Empire Art Metal Co., Inc., College Pt., N. Y.
Erdle Perforating Co., Rochester, N. Y.
Gem Mfg. Co., Pittsburgh, Pa.
Lansing Stamping & Tool Co., Lansing, Mich.
New Britain Mch. Co., New Britain, Conn.

STAMPS.
(Steel.)
Matthews, Jas. H., & Co., Pittsburgh, Pa.
Pannier Brothers Stamp Co., Pittsburgh, Pa.

STAMP SHOES AND DIES.
Midvale Steel Co., Philadelphia, Pa.

STAPLES.
American Steel & Wire Co., Chicago, Ill.

STARTERS.
(Electric Motor.)
Cutler-Hammer Mfg. Co., Milwaukee, Wis.
Crocker-Wheeler Co., Ampere, N. J.
Electric Controller & Mfg. Co., Cleveland, O.
General Electric Co., Schenectady, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

STEAM TRAPS.
National Tube Co., Pittsburgh, Pa.

STEEL.
American Bridge Co., New York, N. Y.
American Vanadium Co., Pittsburgh, Pa.
Bethlehem Steel Co., The, South Bethlehem, Pa.
Bourne-Fuller Co., The, Cleveland, O.
Cambria Steel Co., Philadelphia, Pa.
Camden Forge Company, Camden, N. J.
Carnegie Steel Co., Pittsburgh, Pa.
Central Steel Co., The, Massillon, O.
Disston Sons, Inc., Henry, Philadelphia, Pa.
Franklin Steel Works, Franklin, Pa.
Illinois Steel Co., Chicago, Ill.
Illinois Steel Co., Warehouse Dept., Chicago, Ill.
Illinois Steel Warehouse Co., St. Louis, Mo.
Illinois Steel Warehouse Co., St. Paul, Minn.
La Belle Iron Works, Steubenville, O.
Latrobe Electric Steel Co., Latrobe, Pa.
Lindenberg Steel Co., New York City.
Otis Steel Co., Cleveland, O.
Republic Iron & Steel Co., Youngstown, O.
Ryerson, Jos. T., & Son, Chicago, Ill.
Simonds Mfg. Co., Lockport, N. Y.
Standard Alloys Co., Pittsburgh, Pa.
Tenn. Coal, Iron & R. R. Co., Birmingham, Ala.
United Alloys Steel Corp., The, Canton, O.
Upson Nut Co., Cleveland, O.
Vanadium Alloys Steel Co., Pittsburgh, Pa.
West Leechburg Steel Co., Pittsburgh, Pa.
Whitaker-Glessner Co., Portsmouth Works, Portsmouth, O.
Wickwire Steel Co., Buffalo, N. Y.
Wood, Alan, Iron & Steel Co., Philadelphia.
Youngstown Sheet & Tube Co., Youngstown, O.

STEEL.
(Alloy.)
Central Steel Co., The, Massillon, O.
Columbia Steel & Shafting Co., Pittsburgh, Pa.
Lindenberg Steel Co., New York City.
Midvale Steel Co., Philadelphia, Pa.
Standard Alloys Co., Pittsburgh, Pa.
Union Drawn Steel Co., Beaver Falls, Pa.
United Alloys Steel Corp., The, Canton, O.

STEEL.
(Carbon.)
Latrobe Electric Steel Co., Latrobe, Pa.
Lindenberg Steel Co., New York City.
Ohio Seamless Tube Co., Shelby, O.

STEEL.
(Cold Drawn and Hot Finish.)
Ohio Seamless Tube Co., The, Shelby, O.

STEEL.
(Cold Drawn and Rolled.)
Acme Steel Goods Co., Chicago, Ill.
Bourne-Fuller Co., The, Cleveland, O.
Columbia Steel & Shafting Co., Pittsburgh, Pa.
Moltrup Steel Products Co., Beaver Falls, Pa.
Pittsburgh Cold Rolled Steel Co., Pittsburgh.
Scully Steel & Iron Co., Chicago, Ill.
Standard Gauge Steel Co., Beaver Falls, Pa.
Union Drawn Steel Co., Beaver Falls, Pa.
United Alloys Steel Corp., The, Canton, O.

STEEL.
(Die.)
Firth-Sterling Steel Co., McKeesport, Pa.
Latrobe Electric Steel Co., Latrobe, Pa.

STEEL.
(Electric Furnace.)
Bethlehem Steel Co., The, South Bethlehem, Pa.
Illinois Steel Co., Chicago, Ill.
Latrobe Electric Steel Co., Latrobe, Pa.
United Alloys Steel Corp., The, Canton, O.

STEEL.
(High Speed.)
Bethlehem Steel Co., The, South Bethlehem, Pa.
Bourne-Fuller Co., The, Cleveland, O.
Firth-Sterling Steel Co., McKeesport, Pa.
Latrobe Electric Steel Co., Latrobe, Pa.
Lindenberg Steel Co., New York City.
Midvale Steel Co., Philadelphia, Pa.
Standard Alloys Co., Pittsburgh, Pa.
Vanadium Alloys Steel Co., Pittsburgh, Pa.
Ward's, Edgar T., Sons, Boston, Mass.

STEEL.
(Hollow.)
Empire Art Metal Co., Inc., College Pt., N. Y.

STEEL.
(Manganese.)
Central Steel Co., The, Massillon, O.

STEEL.
(Nickel.)
Latrobe Electric Steel Co., Latrobe, Pa.
United Alloys Steel Corp., The, Canton, O.

STEEL.
(Open-Hearth.)
Bourne-Fuller Co., The, Cleveland, O.
Carnegie Steel Co., Pittsburgh, Pa.
Columbia Steel & Shaft'g Co., Pittsburgh, Pa.
Illinois Steel Co., Chicago, Ill.
Inland Steel Co., Chicago, Ill.
La Belle Iron Works, Steubenville, O.
Union Drawn Steel Co., Beaver Falls, Pa.
Upson Nut Co., Cleveland, O.
Whitaker-Glessner Co., Portsmouth Works, Portsmouth, O.

STEEL.
(Semi.)
McLain's System, Inc., Milwaukee, Wis.

STEEL.
(Semi-High Speed.)
Vanadium-Alloys Steel Co., Pittsburgh, Pa.

STEEL.
(Special Analysis.)
Central Steel Co., The, Massillon, O.

STEEL.
(Spring.)
Firth-Sterling Steel Co., McKeesport, Pa.
United Alloys Steel Corp., The, Canton, O.

STEEL.
(Structural.)
Alliance Structural Co., Alliance, O.
American Bridge Co., New York, N. Y.
Beals & Company, Buffalo, N. Y.
Bellefontaine Bridge & Steel Co., The, Bellefontaine, O.
Belmont Iron Works, Philadelphia, Pa.
Bethlehem Steel Co., South Bethlehem, Pa.
Blaw Steel Construction Co., Hoboken, Pa.
Bourne-Fuller Co., The, Cleveland, O.
Cambria Steel Co., Philadelphia, Pa.
Carnegie Steel Co., Pittsburgh, Pa.
Cincinnati Iron & Steel Co., Cincinnati, O.
Eichleay, John, Jr., Co., Pittsburgh, Pa.
Empire Art Metal Co., Inc., College Pt., N. Y.
Franklin Steel Works, Franklin, Pa.
Klein Iron Works Co., Bellevue, Ohio.
Illinois Steel Co., Chicago, Ill.
Illinois Steel Co., Warehouse Dept., Chicago, Ill.
Illinois Steel Warehouse Co., St. Louis, Mo.
Illinois Steel Warehouse Co., St. Paul, Minn.
Inland Steel Co., Chicago, Ill.
Jones & Laughlin Steel Co., Pittsburgh, Pa.
Lackawanna Steel Co., Buffalo, N. Y.
Lockhart Iron & Steel Co., Pittsburgh, Pa.
McClintic-Marshall Co., Pittsburgh, Pa.
Moltrup Steel Products Co., Beaver Falls, Pa.
Republic Iron & Steel Co., Youngstown, O.
Ryerson, Joseph T., & Son, Chicago, Ill.
Scully Steel & Iron Co., Chicago, Ill.
Tenn. Coal, Iron & R. R. Co., Birmingham, Ala.
Whitaker-Glessner Co., Portsmouth Works, Portsmouth, O.

STEEL.
(Tool.)
American Steel Export Co., New York City.
Bethlehem Steel Co., The, South Bethlehem, Pa.
Bourne-Fuller Co., The, Cleveland, O.
Cincinnati Iron & Steel Co., Cincinnati, O.
Firth-Sterling Steel Co., McKeesport, Pa.
Latrobe Electric Steel Co., Latrobe, Pa.
Lindenberg Steel Co., New York City.
Midvale Steel Co., Philadelphia, Pa.
Ryerson, Joseph T., & Son, Chicago, Ill.
Standard Alloys Co., Pittsburgh, Pa.
Vanadium Alloys Steel Co., Pittsburgh, Pa.
Ward's, Edgar T., Sons, Boston, Mass.

STEEL.
(Vanadium.)
American Vanadium Co., Pittsburgh, Pa.
Latrobe Electric Steel Co., Latrobe, Pa.
United Alloys Steel Corp., The, Canton, O.

STEEL.
(Vanadium Alloy.)
Vanadium-Alloys Steel Co., Pittsburgh, Pa.

STEEL PLATE CONSTRUCTION.
Knox Pressed & Welded Steel Co., Pittsburgh.

STENCILS.
(Brass and Rubber.)
Matthews, Jas. H., & Co., Pittsburgh, Pa.

STOKERS.
Babcock & Wilcox Co., The, New York City.
Erie Foundry Co., Erie, Pa.
Green Engineering Co., Chicago, Ill.
Hagan, Geo. J., Co., Pittsburgh, Pa.

STOOLS.
(Steel.)
Angle Steel Stool Co., Otsego, Mich.

STRAIGHTENING MACHINERY.
Abramsen Engineering Co., Pittsburgh, Pa.

STRAND.
(Common, Special Strength.)
Roebling's, John A., Sons Co., Trenton, N. J.

STRAP JOINTS.
Leard, Wm. E., New Brighton, Pa.

STRAPS.
(Rod.)
Camden Forge Co., Camden, N. J.

SULPHURIC ACID.
Amer. Zinc, Lead & Smelt'g Co., New York.

SULPHATE OF IRON.
American Steel & Wire Co., Chicago, Ill.

SWITCHBOARDS.
Electric Controller & Mfg. Co., Cleveland, O.

SWITCHES.
(Electric.)
Electric Controller & Mfg. Co., Cleveland, O.
General Electric Co., Schenectady, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

SWITCH STANDS.
Bethlehem Steel Co., The, South Bethlehem, Pa.

SYNDOLAG.
Davison, Allen S., Co., Pittsburgh, Pa.

TACKS.
American Steel & Wire Co., Chicago, Ill.

TANKS.
(Acetylene.)
National Tube Co., Pittsburgh, Pa.
Linde Air Products Co., New York, N. Y.
Oxweld Acetylene Co., Chicago, Ill.
Prest-O-Lite Co., The, Indianapolis, Ind.

TANKS.
(Acid Storage.)
Hauser-Stander Tank Co., The, Cincinnati, O.
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

TANKS.
(Steel.)
American Bridge Co., New York, N. Y.
Gilbert & Barker Mfg. Co., Springfield, Mass.
Morgan Construction Co., Worcester, Mass.
National Tube Co., Pittsburgh, Pa.
Phoenix Iron Works Co., Meadville, Pa.
Riter-Conley Mfg. Co., Pittsburgh, Pa.

TANKS.
(Wooden.)
Hauser-Stander Tank Co., Cincinnati, O.

TAR EXTRACTORS.
Smith Gas Engrg. Co., The, Lexington, O.

TELEGRAPH AND TELEPHONE WIRE.
Roebling's, John A., Sons Co., Trenton, N. J.

THREAD CUTTING TOOLS.
Landis Machine Co., Waynesboro, Pa.

TILE.
(Fire Clay.)
Trussed Concrete Steel Co., Detroit, Mich.
Union Mining Co., Mt. Savage, Md.

TIN.
(Chinese.)
Wah-Chang Mining & Smelting Co., New York City.

TIN PLATE.
American Sheet & Tin Plate Co., Pittsburgh.
American Steel Export Co., New York City.
Jones & Laughlin Steel Co., Pittsburgh, Pa.
Standard Tin Plate Co., Canonsburg, Pa.
Taylor, N. & G., Co., Philadelphia, Pa.
Trumbull Steel Co., The, Warren, O.

TIN PLATE MILL EQUIPMENT.
Birdsboro Steel Fdy. & Mch. Co., Birdsboro, Pa.
United Eng. & Fdy. Co., Pittsburgh, Pa.

TIRES.
(Locomotive and Car Wheel.)
American Vanadium Co., The, Pittsburgh, Pa.
Midvale Steel Co., The, Philadelphia, Pa.

TITANIUM.
Titanium Alloy Mfg. Co., Niagara Falls, N. Y.

TOE CALKS.
(Steel.)
American Steel & Wire Co., Chicago, Ill.

TOOL HOLDER BITS.
(Treated.)
Vanadium-Alloys Steel Co., Pittsburgh, Pa.

TOOL TRUCKS.
(Steel.)
Angle Steel Stool Co., Otsego, Mich.

TOOLS.
(Electric.)
General Electric Co., Schenectady, N. Y.

TOOLS.
(Hydraulic.)
Southwark Fdy. & Mch. Co., Philadelphia, Pa.

TOOLS.
(Pneumatic.)
Cleveland Pneumatic Tool Co., Cleveland, O.
Oldham, Geo., & Sons Co., Frankford, Philadelphia, Pa.
Ryerson, Jos. T., & Son, Chicago, Ill.

TOOLS.
(Special Machinery.)
Lansing Stamping & Tool Co., Lansing, Mich.
Parker Machine Co., Boston, Mass.

TOOLS.
(Woodworking.)
White, L. & I. J., Co., Buffalo, N. Y.

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New York Office, 30 Church Street; Chicago Office, 1823 Monadnock Block; Philadelphia Office, Bourse Building; Detroit Office, H. S. Kendel, 14 Cadillac Square

TORCHES.
(Acetylene, Blow, Oxy-acetylene.)
Linde Air Products Co., New York, N. Y.
Oxweld Acetylene Co., Chicago, Ill.
Prest-O-Lite Co., The, Indianapolis, Ind.

TRACK AND RAIL SUPPLIES.
American Steel Export Co., New York City.
Bethlehem Steel Co., South Bethlehem, Pa.
Bourne-Fuller Co., The, Cleveland, O.
Carnegie Steel Co., Pittsburgh, Pa.
Chase Foundry & Mfg. Co., Columbus, O.
Illinois Steel Co., Chicago, Ill.
Illinois Steel Co., Warehouse Dept., Chicago, Ill.
Illinois Steel Warehouse Co., St. Louis, Mo.
Illinois Steel Warehouse Co., St. Paul, Minn.
Lackwanna Steel Co., Buffalo, N. Y.
Lakewood Engineering Co., Cleveland, O.
Republic Iron & Steel Co., Youngstown, O.
Tenn. Coal, Iron & R. R. Co., Birmingham, Ala.

TRAMRAILS.
(Overhead Systems.)
Brown Hoisting Machinery Co., Cleveland, O.
Whiting Foundry Equipment Co., Harvey, Ill.

TRAMWAYS.
Link-Belt Company, Chicago, Ill.

TRAMWAYS.
(Wire Rope.)
American Steel & Wire Co., Chicago, Ill.

TRANSFORMERS.
General Electric Co., Schenectady, N. Y.

TRANSMISSION CHAINS.
Link-Belt Company, Chicago, Ill.

TRANSMISSION TOWERS.
Blaw Steel Construction Co., Hoboken, Pa.

TROLLEYS.
Browning Co., Cleveland, O.
Chisholm & Moore Mfg. Co., The, Cleveland.
O. M. S. Company, The, Chicago, Ill.
Shepard Electric Crane & Hoist Co., Montour Falls, N. Y.
Whiting Foundry Equipment Co., Harvey, Ill.

TRUCKS.
(Foundry.)
Lakewood Engineering Co., Cleveland, O.
Standard Scale & Supply Co., Pittsburgh, Pa.

TRUCKS.
(Industrial.)
Angle Steel Stool Co., Otsego, Mich.
Atlas Car & Mfg. Co., Cleveland, O.
Lakewood Engrg. Co., Cleveland, O.
Morgan Construction Co., Worcester, Mass.
Whiting Foundry Equipment Co., Harvey, Ill.

TRUCKS.
(Rod, Show, Box, Wire Mills.)
Lakewood Engineering Co., Cleveland, O.
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

TRUCKS.
(Small, Hand.)
Angle Steel Stool Co., Otsego, Mich.
Lakewood Engineering Co., Cleveland, O.
Standard Scale & Supply Co., Pittsburgh, Pa.

TUBE MILL MACHINERY.
(Seamless and Welded.)
Standard Engrg. Co., Ellwood City, Pa.

TUBES.
(Boiler.)
Allegheny Steel Co., The, Pittsburgh, Pa.
Bourne-Fuller Co., The, Cleveland, O.
Detroit Seamless Steel Tube Co., Detroit, Mich.
National Tube Co., Pittsburgh, Pa.
Ryerson, Joseph T., & Son, Chicago, Ill.
Scully Steel & Iron Co., Chicago, Ill.
Worth Brothers Co., Philadelphia, Pa.

TUBES.
(Butt and Lap Welded.)
American Steel Export Co., New York City.
Dodd, Theo. L., Chicago, Ill.
Empire Art Metal Co., Inc., College Pt., N. Y.
La Belle Iron Works, Steubenville, O.
National Tube Co., Pittsburgh, Pa.
Republic Iron & Steel Co., Youngstown, O.
Youngstown Sheet & Tube Co., Youngstown, O.

TUBES.
(Cold Drawn Seamless Steel.)
Detroit Seamless Steel Tubes Co., Detroit, Mich.
Empire Art Metal Co., Inc., College Pt., N. Y.
Ohio Seamless Tube Co., The, Shelby, O.

TUBES.
(Seamless Steel.)
Empire Art Metal Co., Inc., College Pt., N. Y.
National Tube Co., Pittsburgh, Pa.
Ohio Seamless Tube Co., The, Shelby, O.
Ward's Edgar T., Sons, Boston, Mass.

TUBING.
Empire Art Metal Co., Inc., College Pt., N. Y.
National Tube Co., Pittsburgh, Pa.
Ohio Seamless Tube Co., The, Shelby, O.

TUBING.
(Seamless and Brazed Brass and Copper.)
Gardner, B. M., Co., The, Cleveland, O.

TUBING.
(Vanadium Steel.)
American Vanadium Co., The, Pittsburgh, Pa.

TUBS.
(Cleaning House and Galvanizing Plant.)
Turner, Vaughn & Taylor, Co., Cuyahoga Falls, O.

TUMBLING MILLS.
Whiting Fdy. Equipment Co., Harvey, Ill.

TUNGSTEN.
Wah-Chang Mining & Smelting Co., New York.

TUNGSTEN ORE.
Vasco Mining Company, Boulder, Colo.

TURBINES.
(Steam.)
General Electric Co., Schenectady, N. Y.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

TURBINE SHAFTS.
Camden Forge Co., Camden, N. J.

TURNBUCKLES.
American Bridge Co., New York, N. Y.
American Iron & Steel Mfg. Co., Lebanon, Pa.
Bourne-Fuller Co., The, Cleveland, O.
Michigan Bolt & Nut Works, Detroit, Mich.
Milton Mfg. Co., Milton, Pa.
Republic Iron & Steel Co., Youngstown, O.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.

TURNTABLES.
American Bridge Co., New York, N. Y.
Atlas Car & Mfg. Co., Cleveland, O.
Chase Foundry & Mfg. Co., Columbus, O.
Lakewood Engrg. Co., Cleveland, O.
Whiting Foundry Equipment Co., Harvey, Ill.

UNION COUPLINGS.
(Cold Drawn Steel.)
Mark Mfg. Co., Evanston, Ill.

UNIONS.
(Pipe.)
Dart, E. M., Co., Providence, R. I.
Illinois Tube Co., Pittsburgh, Pa.
Mark Mfg. Co., Evanston, Ill.
National Tube Co., Pittsburgh, Pa.

VALVE LEATHERS.
Graton & Knight Mfg. Co., Worcester, Mass.
Scully Steel & Iron Co., Chicago, Ill.
Williams, I. B., & Sons, Dover, N. H.

VALVES AND FITTINGS.
Best Company, Pittsburgh, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Connersville Blower Co., The Connersville, Ind.
Dayton Steel Foundry Co., Dayton, O.
Mackintosh, Hemphill & Co., Pittsburgh, Pa.
Morgan Construction Co., Worcester, Mass.
National Tube Co., Pittsburgh, Pa.
Pittsburgh Piping & Equip. Co., Pittsburgh.

VALVES AND FITTINGS.
(Hydraulic.)
Hydraulic Press Mfg. Co., Mount Gilead, O.
Southwark Fdy. & Mch. Co., Philadelphia, Pa.

VANADIUM.
American Vanadium Co., Pittsburgh, Pa.

VATS.
(Acid and Chemical.)
Hauser-Stander Tank Co., The, Cincinnati, O.

WASHED METAL.
Brier Hill Steel Co., Youngstown, O.

WASHER CUTTING MACHINES.
Southwark Foundry & Mach. Co., Philadelphia.

WASHERS.
(Iron and Steel.)
American Iron & Steel Mfg. Co., Lebanon, Pa.
Bayonne Bolt & Nut Co., Bayonne, N. J.
Bettcher Mfg. Co., Cleveland, O.
Bourne-Fuller Co., The, Cleveland, O.
Milton Mfg. Co., Milton, Pa.
Oliver Iron & Steel Co., Pittsburgh, Pa.
Russell, Burdsall & Ward Bolt & Nut Co., Port Chester, N. Y.
Upson Nut Co., Cleveland, O.
Wrought Washer Mfg. Co., Milwaukee, Wis.

WASHERS.
(Leather.)
Graton & Knight Co., The, Worcester, Mass.
Williams, I. B., & Sons, Dover, N. H.

WATER CINDER MILLS.
Whiting Foundry Equipment Co., Harvey, Ill.

WELDED PRODUCTS.
(Electric.)
Standard Screw Products Co., Detroit, Mich.

WELDED STEEL PLATE CONSTRUCTION.
Knox Pressed & Welded Steel Co., Pittsburgh.

WELDING.
(Custom.)
K. & G. Welding & Cutting Co., New York.
Linde Air Products Co., New York, N. Y.
Oxweld Acetylene Co., Chicago, Ill.
Thomson Electric Welding Co., Lynn, Mass.

WELDING.
(Oxy-Acetylene Process.)
Knox Pressed & Welded Steel Co., Pittsburgh.

WELDING AND CUTTING APPARATUS.
(Electric.)
General Electric Co., Schenectady, N. Y.
Thomson Electric Welding Co., Lynn, Mass.
Toledo Electric Welder Co., Cincinnati, O.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

WELDING AND CUTTING APPARATUS.
(Oxy-Acetylene Process.)
K. & G. Welding & Cutting Co., New York.
Linde Air Products Co., New York, N. Y.
Oxweld Acetylene Co., Chicago, Ill.
Prest-O-Lite, The, Co., Indianapolis, Ind.

WHEELBARROWS.
Lakewood Engrg. Co., Cleveland, O.

WHEELS.
(Car.)
American Steel Export Co., New York City.
American Steel Foundries, Chicago, Ill.
Carnegie Steel Co., Pittsburgh, Pa.
National Malleable Castings Co., Cleveland, O.

WHEELS.
(Rolled Steel.)
Midvale Steel Co., Philadelphia, Pa.

WHEELS.
(Rope.)
Cooper, C. & G., Mt. Vernon, O.
Mesta Machine Co., Pittsburgh, Pa.

WHEELS.
(Steel Tired.)
Midvale Steel Co., Philadelphia, Pa.

WHEELS.
(Steel Truck.)
Dayton Steel Foundry Co., Dayton, O.

WIRE.
(Barb and Fence.)
American Steel & Wire Co., Chicago, Ill.
Youngstown Sheet & Tube Co., Youngstown, O.

WIRE.
(Broom.)
American Steel & Wire Co., Chicago, Ill.

WIRE.
(Enameled Magnet.)
American Steel & Wire Co., Chicago, Ill.

WIRE.
(Fence.)
American Steel & Wire Co., Chicago, Ill.

WIRE.
(Fence, Woven.)
American Steel & Wire Co., Chicago, Ill.

WIRE.
(Fine.)
American Steel & Wire Co., Chicago, Ill.

WIRE.
(Flat and Round.)
American Steel & Wire Co., Chicago, Ill.

WIRE.
(Flat, High or Low Carbon.)
American Steel & Wire Co., Chicago, Ill.

WIRE.
(Ignition.)
American Steel & Wire Co., Chicago, Ill.

WIRE.
(Lath.)
Wright Wire Co., Worcester, Mass.

WIRE.
(Mattress.)
American Steel & Wire Co., Chicago, Ill.

WIRE.
(Piano and Music.)
American Steel & Wire Co., Chicago, Ill.

WIRE.
(Pipe Organ.)
American Steel & Wire Co., Chicago, Ill.

WIRE.
(Rubber Covered.)
American Steel & Wire Co., Chicago, Ill.

WIRE.
(Screw Driver.)
American Steel & Wire Co., Chicago, Ill.

WIRE.
(Telephone and Telegraph.)
American Steel & Wire Co., Chicago, Ill.

WIRE.
(Threaded.)
Progressive Mfg. Co., Torrington, Conn.

WIRE.
(Vanadium.)
American Vanadium Co., Pittsburgh, Pa.

WIRE.
(Weaving.)
American Steel & Wire Co., Chicago, Ill.

WIRE AND CABLES.
(Electric.)
American Steel & Wire Co., Chicago, Ill.

WIRE CLOTH.
Wright Wire Co., Worcester, Mass.

WIRE FENCING.
Wright Wire Co., Worcester, Mass.

WIRE GRILLES.
(Window, Machinery, Tool Room.)
Wright Wire Co., Worcester, Mass.

WIRE GUARDS.
Wright Wire Co., Worcester, Mass.

WIRE MILL MACHINERY.
Blake & Johnson Co., Waterbury, Conn.
Kilby Mfg. Co., Cleveland, O.
Morgan Construction Co., Worcester, Mass.
Turner, Vaughn & Taylor Co., Cuyahoga Falls, O.

WIRE RODS.
(Steel.)
American Steel & Wire Co., Chicago, Ill.

WIRE ROPE AND FITTINGS.
American Steel & Wire Co., Chicago, Ill.
Roebling's, John A., Sons Co., Trenton, N. J.
Wright Wire Co., Worcester, Mass.

WIRE ROPE SLINGS.
Roebling's, John A., Sons Co., Trenton, N. J.

WIRE, WIRE RODS AND WIRE PRODUCTS.
American Steel & Wire Co., Chicago, Ill.
Cambria Steel Co., Philadelphia, Pa.
Jones & Laughlin Steel Co., Pittsburgh, Pa.
Roebling's Sons Co., John A., Trenton, N. J.
Wickwire Steel Co., Buffalo, N. Y.
Youngstown Sheet & Tube Co., Youngstown, O.

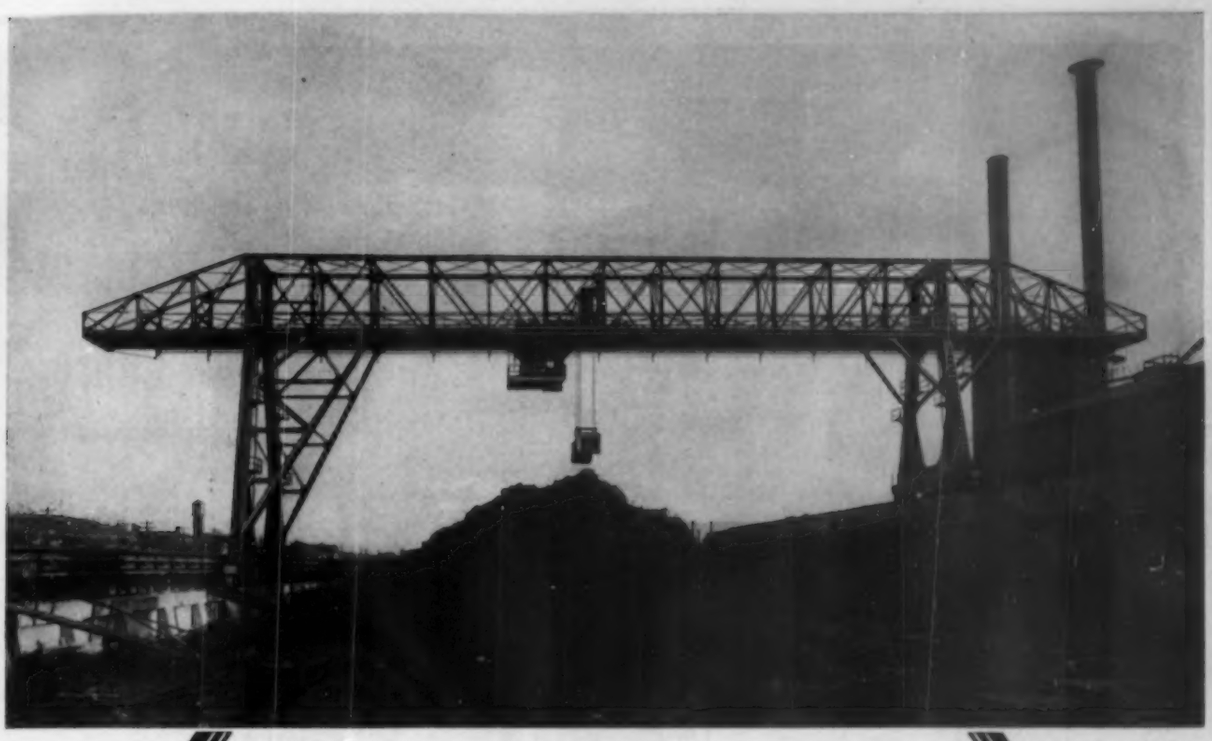
WOODEN TANKS.
Hauser-Stander Tank Co., The, Cincinnati, O.

WOODWORKING MACHINERY.
Oliver Machinery Co., Grand Rapids, Mich.

WRENCHES.
(Pipe.)
Drop Forge Co. of N. J., Jersey City, N. J.

WRENCHES.
(Reversible.)
Lowell Wrench Co., Worcester, Mass.

See Index to Advertisements for Pages Containing Advertisements of Companies Listed Above



Another "Alliance" Economizer

¶ This Seven and One-half Ton, Eight-Motor Type Ore Bridge with 167-foot span, was installed by us in the plant of the Pennsylvania Steel Co., Steelton, Pa. It has cantilever extensions of respectively 39 feet 3½ inches, and 52 feet.

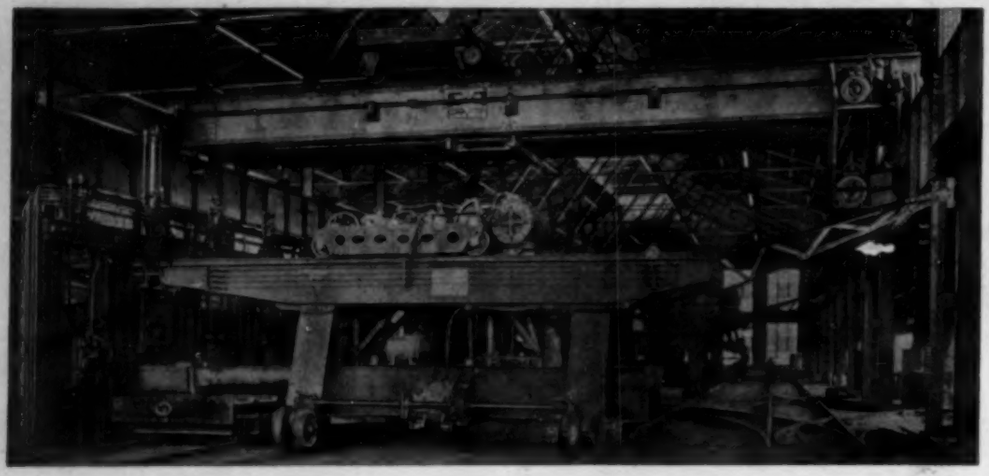
¶ If you are up against a difficult proposition, and wish to have it solved RIGHT, send us your specifications, because *"Alliance" Progressive Engineering Developments begin where others leave off.*

¶ We are the largest manufacturers of the world's largest cranes.

Ask us to send you our New Catalog

The Alliance Machine Company

Pittsburgh **Alliance, Ohio** **Birmingham**



The Accurate Charge

is made with a Morgan machine. We illustrate above a high type open hearth floor charging machine. It allows crane to travel freely over machine, reducing cost of charging a furnace to the minimum. Our new locking device is very much superior to anything heretofore in use—prevents boxes being lost in furnace. Our experience in meeting steel mill conditions enables us to install equipment which will stand the all-day, every-day test.

Write for bulletin

Ask about our special bronze-bearings and bushings of all kinds—acid resisting—and special bronze chain for pickling purposes

PITTSBURGH, PA. Oliver Building
BIRMINGHAM, ALA. American Trust Bldg.
BRUSSELS, BELGIUM
COPENHAGEN
TOKIO

The MORGAN ENGINEERING COMPANY
ESTABLISHED 1868
Alliance, Ohio. U.S.A.

NEW YORK 165 Broadway
PETROGRAD M. Mett & Co.
LONDON
PARIS

Industrial Works Locomotive Cranes

INCREASE PROFITS BY DECREASING HANDLING COSTS

Write for a Catalog

Industrial Works

BAY CITY, MICHIGAN

New York Office, 50 Church Street; Philadelphia Office, Widener Bldg.; J. G. Miller, St. Louis; C. B. Davis Engineering Company, Birmingham; F. H. Hopkins & Company, Montreal; N. B. Livermore & Company, San Francisco and Los Angeles; Northwestern Equipment Company, Portland and Seattle.

Wrecking and Locomotive Cranes—from 5 to 160 tons Capacity—Transfer Tables—Pile Drivers—Grab Buckets—Lifting Magnets.

THE McMYLER-INTERSTATE COMPANY

CLEVELAND CHICAGO NEW YORK LONDON

We manufacture—All types of Cranes, Clam Shell and Orange Peel and Concrete Buckets; Pile Drivers, etc. Each inquiry given careful attention. Bulletins will be sent on request.

Write office nearest you.

"SAFETY FIRST"!

The elements of SAFETY are inherent in the rugged design and construction of

SHAW CRANES

Send for Bulletins describing Shaw Type Z Motors, Type S Controllers, Type B Safety Hoist Limit and other salient features.

MANNING, MAXWELL & MOORE, Inc., Shaw Electric Crane Co. Dept.

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BRANCH OFFICES:

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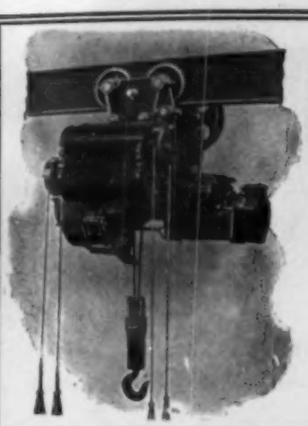
Cleveland, Ohio
Detroit, Mich.
Boston, Mass.
Buffalo, N. Y.
Milwaukee, Wis.
New Haven, Conn.
Philadelphia, Pa.
Pittsburgh, Pa.
St. Louis, Mo.
San Francisco, Cal.



The Initial Cost

of a "P & H" Type "U" Hoist is surprisingly low — but it's the return on your investment that you should consider.

The Type "U" will save the wages of half a dozen men. Capacities: ½ to 6 Tons.

Pawling & Harnischfeger Co.
Milwaukee, Wis.

¼ Ton ½ Ton

1 Ton

Handle Small Loads Economically

The introduction of these small Shepard hoists offers a solution to many problems where the handling of goods expeditiously is of importance. Their use saves work to the mutual advantage of employer and employee.

The distinctive features of Shepard design are: Balanced Drive, Permanent Alignment, Total Dirt Exclusion, Automatic Oil Bath Lubrication, "Unit" Frame and Enclosures.

Write today for Bulletin B-8

Shepard Electric Crane & Hoist Co.
Main Office and Works, MONTOUR FALLS, N. Y.
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ELECTRIC EUCLID HOISTS

Four Points of Euclid Superiority

Here are four reasons for the recognized superiority of Euclid Hoists:

1. The main casting is made in one part and contains all the bearings and the motor shaft.
2. Every part is quickly accessible, and repairs, when necessary, may be made "on a ladder."
3. The brake is simple and efficient and eliminates the use of an electric brake, except in rare cases.
4. They are so designed that any standard motor can be used.

There are other reasons, write for our new catalogue and learn about them.

The Euclid Crane & Hoist Co.
Department B. Euclid, Ohio

NORTHERN CRANES

Electric and Hand Traveling Cranes. Electric and Air Hoists and Trollies.
NORTHERN ENGINEERING WORKS, DETROIT, MICH. (Canadian Works: Northern Crane Works, Ltd., Walkerville, Ont.)

PNEUMATIC GEARED **HOISTS** 1 to 15 Tons

MOTORS 2 TO 20 H. P. FOR Cranes Derricks Winches

Detroit Hoist & Machine Co.
DETROIT, MICH.

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THE BROWNING COMPANY, CLEVELAND
SALES OFFICES: NEW YORK, CHICAGO, PHILADELPHIA, SAN FRANCISCO

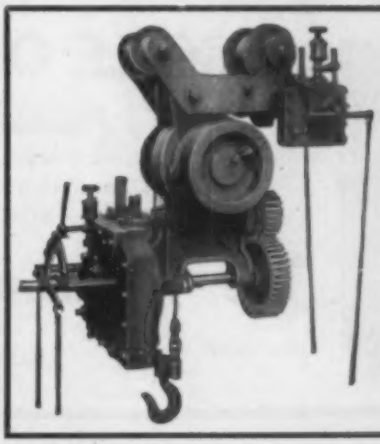
O. S. LOCOMOTIVE CRANES

One O. S. Locomotive Crane will take the place of many men, and the work that would have taken the men days, is accomplished in minutes.

Our free catalogs illustrate the various uses of O. S. Locomotive Cranes. Let us send you one.

Write us immediately

Orton & Steinbrenner Co.
Chicago, Ill.
Shops, Huntington, Ind.



Dake Engine Co.

Grand Haven Michigan

New York Agent: H. L. Drullard, 30 Church St.
Chicago Agent: J. E. Chisholm, 1410 Fisher Bldg.
Detroit Agent: Derrick Supply Co., 1070 Penobscot Bldg.

Manufacturers of

Pneumatic and Electric Geared Hoists, Steam and Air Motors, Hoisting Engines, Swinging Engines, Motor Crabs, Drill Hoists, Spud Hoists, Marine Machinery, etc.

Write for Catalog and Prices.

NILES CRANES

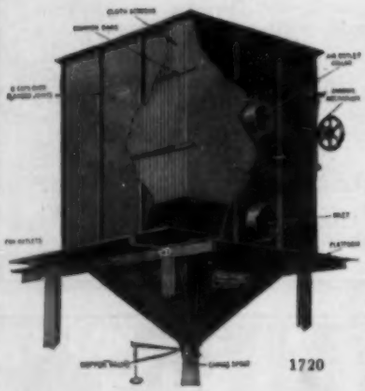
For Machine Shops, Foundries, Railway Repair Shops, Shipyards, Lumber and Stone Yards

Write for Catalogue "Niles Cranes"

NILES-BEMENT-POND CO., 111 Broadway, New York

Boston Philadelphia Pittsburgh Chicago St. Louis Birmingham

Dust Arresters



Designed for taking care of dust from exhaust tumbling mills, emery wheels, sandblast barrels, sandblast table machines, sandblast rooms, etc.

The dust-laden air after passing through arrester can be discharged back into shop absolutely free from all dust.

We Equip Cleaning Rooms Complete

Write for Tumbler and Dust Arrester Catalog No. 120

Complete Foundry Equipment

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FOUNDRY EQUIPMENT CO.
HARVEY-ILL. U.S.A.
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Cranes of all Kinds

"THE STANDARD" RAILROAD TRACK SCALES
are built for accuracy and strength.

Our latest extra heavy iron frame track scales are everywhere known as durable, accurate, and well adapted for railway use and large industries. We build scales for every purpose.

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Roller Bearing Cars and Trucks of All Kinds for All Purposes, Switches, Turntables and Complete Industrial Railway Equipments

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We build machinery which is especially designed to meet the conditions found at By-product coke oven plants.

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NOISELESS PINIONS
for motor and other high speed drives.
See our large advertisement in the first issue of the month
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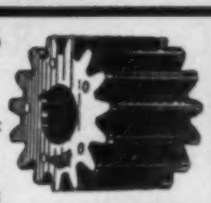

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PEERLESS RAWHIDE PINIONS
Accurate - Efficient - Durable
Are being used today with great success in many of the largest shops.
We also manufacture all styles and sizes of METAL GEARS.
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BEVEL GEARS
Cut theoretically correct
Special facilities for cutting Worm, Spiral, Mitre, Internal and Elliptical Gear Wheels
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IRON OR STEEL
CUT OR MACHINE MOLDED
TAYLOR-WILSON MFG. CO
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Gears of All Descriptions
to 24 feet diameter, including cut herringbone gears with teeth cut from solid blanks
Heavy Machinery Designed and Furnished for All Purposes
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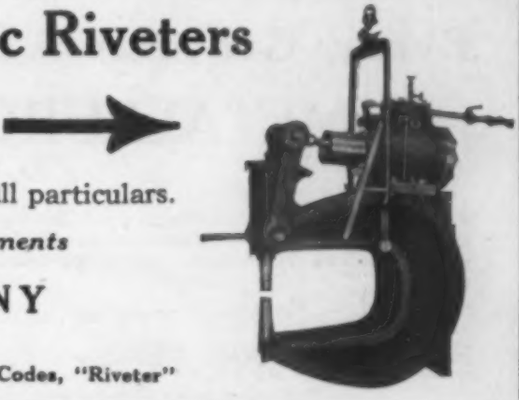
Screw Machine and Electric Welded Products
DETROIT, MICH. Estimates to your specifications

Allen Portable Pneumatic Riveters

assure you the *fastest* and *tightest riveting* at the *lowest cost*



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FOR ALL PURPOSES

Cold Rolling Machinery
FOR FLAT WIRE
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WATERBURY, CONN. (Since 1849)

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We Solicit Your Inquiries
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For Open Hearth Furnaces, Billet Heating, Welding, Annealing, Lime, Brick and Cement Burning, Ore Roasting, Glass Melting and various Metallurgical and Chemical Processes. Fully described in catalogue.
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Forging Machines, Chilled Rolls, Rolling Mill Machinery, Special Machinery
Presses, Shears, Straighteners, Accumulators
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Standard, Extra Heavy and water cooling. All sizes, from 18" to 52".
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STEAM HAMMERS
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Built in all sizes for every class of work.
ECONOMICAL—RELIABLE—EFFICIENT
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The most comprehensive and thorough treatise on alloying that has yet been published. The author is a practical man of many years' experience and has written this book with a view of meeting the every-day needs of the foundryman.
The tables alone are worth many times the price of the book. 205 pages, 6x9 inches, 41 illustrations, handsomely bound in two colors. *Price, $2.50, Postpaid.* Penton's Book News, Cleveland, O.

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It presents many new subjects, principles and ideas—none, however, that have not been tried satisfactorily by the author. It is void of confusing minutiae and is clearly and forcibly written.
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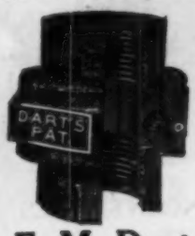

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Automobile Axle Housings, Wheel Carriers, Steering Columns, Radius Rods, Torsion Tubes, Drive Shaft Housings and other Automobile parts.

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AUTOMATIC AIR HOSE COUPLINGS
AND NEVER-SLIP HOSE CLAMPS
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Saves Air Time and Temper

Tight Under all Pressures

OVER 1,000,000 IN GENERAL USE
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Specify Hauser-Stander Tanks
Wooden Tanks, all shapes and sizes, for every duty
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Reinforced Concrete
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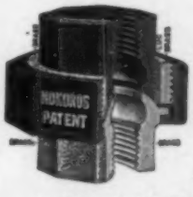

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Absolutely Non-Corrosive
At all contact points
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Made of Air Furnace Malleable Iron and Best Steam Metal

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Economically and quicker than Gas
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W. N. Best Pat'd Oil Burner Tanks, Pumps, Boilers and Piping

Complete Installations by
BEST COMPANY, Pittsburg, Pa.

At work in a
New York Subway Cave-in

The illustration shows a K-G outfit at work in one of the subway cave-ins in New York.

Operator has just cut beam in foreground and is now salving the large pipe, running lead out of the joints, thus saving the pipe intact.

The above is a very good example of one of the many uses for a K-G outfit. Under all conditions it is a guarantee of swift, efficient and economical operation.

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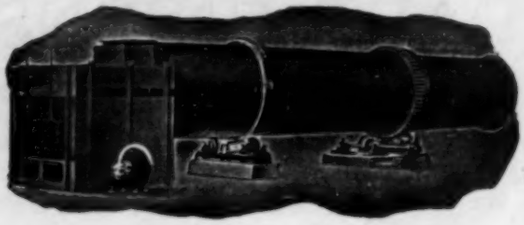
556 West 34th Street NEW YORK CITY



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THOMSON Electric Welders
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Weld your High Speed Steels

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"ALL THERE IS TO SAY ON A FILE"

A File for every use and *every* one the best that brains can make and money buy.

Specify "NICHOLSON" When ordering Files

See "Iron Trade Review," Dec. 21, 1916, Page 30

NICHOLSON FILE CO. - Providence, R. I.

Finished keys and plates of quality

Moltrup's Finished Keys are a guarantee of satisfaction. Ask any user. *Moltrup's Steel Pattern Plates* are light, strong, rigid and permanent. They are absolutely free from surface imperfections. ¶ Let us show you how to eliminate trouble and heavy expenses.
Get in touch with us at once.

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Beaver Falls, Pa.

"GRAINGER PUMPS"

Boiler Feed Pumps
Tank and Light Service Pumps
General Service Pumps

Made by

J. J. REILLY MANUFACTURING CO.
North Tenth Street
Write for Prices. LOUISVILLE, KENTUCKY

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The Wickes

Continuous Electric. Sells at **half** the **price.** Uses **half** the **current** of others. Perfect prints up to 48" in width and of unlimited length.

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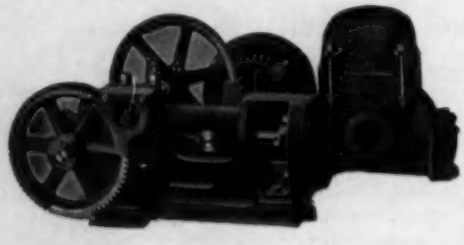
Department A
Saginaw - Mich.



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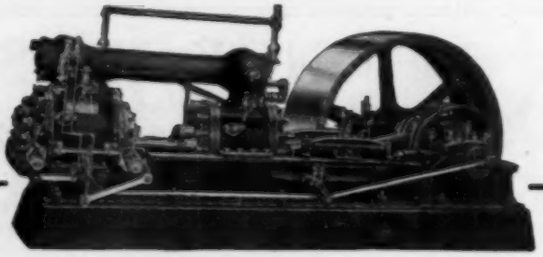
NOT IN THE PUMP TRUST.



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These improvements mark a new era in compressor construction. They gain the instant and favorable attention of all skilled engineers.

For the usual hackneyed claims of ECONOMY, DURABILITY and EFFICIENCY, let our forty years' experience be an assurance of adequate and discerning attention to every feature.

THE NORWALK IRON WORKS CO., South Norwalk, Conn.

Corrugated Roofing

APOLLO BEST BLOOM Galvanized
APOLLO-KEYSTONE Copper Steel Galvanized
AMERICAN Black and Painted

Honestly Made— AMERICAN SHEET & TIN PLATE CO. APOLLO ROOFING TRADE MARK REGISTERED PITTSBURGH *—Honestly Sold*

Our Formed Roofing and Siding Products are full weight, accurately formed, and carefully manufactured in every detail. Our booklet *Better Buildings* contains valuable roofing information.

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Guillotine Plate Shears, Forging Presses, Punches, Riveters and General Steel Working Tools. Accumulators, Pressure Pumps, Steam and Centrifugal Pumps, Gas Holders, Gas Power Plants with Producers. :: :: ::

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All sizes. Various types of die holders

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PANGBORN
CORPORATION
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We make
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is a patented Automatic Filling Valve that eliminates elevating buckets, chains, overhead hoppers. No sand valves to wear. 30% to 50% higher efficiency than any suction system. Less than half the mechanism of any other pressure system.

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Our Patent Flanged Lip Screen.

PERFORATED METALS

OF EVERY DESCRIPTION

Elevator Buckets, Stacks and Tanks

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"Capital" Blued and Polished "Capital"

More than 300 sizes in stock

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We also carry Cold Rolled Tool Steel TO TEMPER

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Open Hearth Furnaces, Forging Hammers
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PRODUCING:

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SERVING:

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DIVERSIFIED SHEET AND TIN MILL PRODUCTS

TRUMBULL ROOFING AND SIDING

All styles manufactured from our own Sheet and Tin Mill Products

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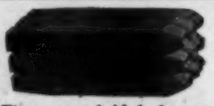

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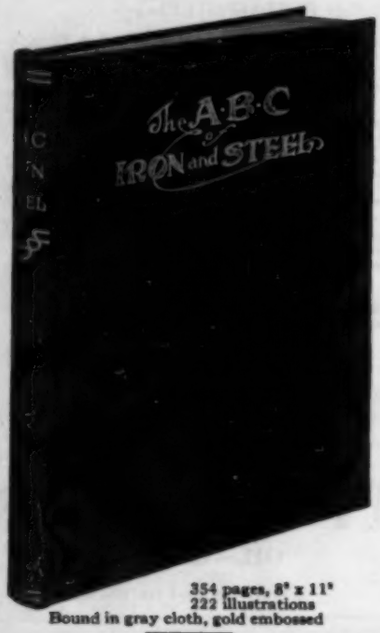

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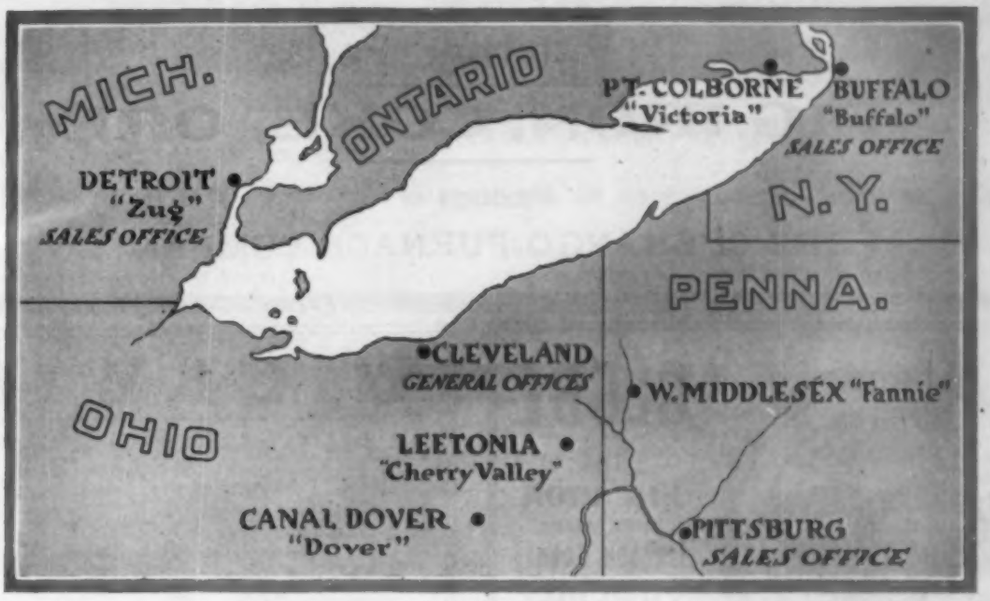

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WHEN YOU NEED A HIGH GRADE executive, engineer, draftsman, or any technical man, consult The Engineering Agency, Inc., (Est. 24 years), 1662 Monadnock Block, Chicago.

Mr. Manufacturer

Here's the weekly exchange where Competent—wide-awake—industrious—men with initiative can be communicated with quickly.

51

Positions Wanted

AN ENGINEER WITH MANY YEARS experience as chief executive of one of the most widely known plants in the United States specializing in structural and plate work for steel plants, who has an intimate knowledge of the operations of every department, including purchasing, estimating, sales, manufacturing and financial, is desirous of making a new connection. At present engaged in an executive capacity, but can give excellent reasons for desiring change. Address Box 970, THE IRON TRADE REVIEW, Cleveland, O.

ASSISTANT SUPERINTENDENT OR general foreman of steel foundry; 20 years experience in foundries, producing car and miscellaneous castings, and ingots. Capable of assuming charge of operations. Address Box 344, THE IRON TRADE REVIEW, Cleveland, O.

POSITION AS ROLLER. EXPERIENCED on continuous merchant mills. Am employed but desire a change. Experienced on small rounds, squares, flats, angles and other small shapes. Address Box 352, THE IRON TRADE REVIEW, Cleveland, O.

MASTER MECHANIC DESIRES A change. Have had over 12 years experience as master mechanic of Blast Furnace and Steel Plant work. Am thoroughly familiar with erection and maintenance and the management of help. Address Box 345, THE IRON TRADE REVIEW, Cleveland, O.

MECHANICAL AND ELECTRICAL ENgineer desires position in engineering department of manufacturing company. Position to lead to that of sales engineer; 6 years general designing experience; steel plant, by-product coke plant, heavy machinery and conveying equipment. Cleveland preferred. Interview desired. Address Box 343, THE IRON TRADE REVIEW, Cleveland, O.

PIG IRON, COKE AND COAL SALESman would like to represent you; have had six years selling experience and am thoroughly acquainted in the Pittsburgh district. Address Box 359, THE IRON TRADE REVIEW, Pittsburgh, Pa.

POSITION AS MASTER MECHANIC or Maintenance Engineer with a good manufacturing concern, by a going man. Hustler and ont afraid of work. Have had eight years experience with machinery and engines and eight years in drafting office. Best of references. Address Box 355, THE IRON TRADE REVIEW, Cleveland, O.

AS ASSISTANT SUPERINTENDENT where there is a chance for advancement; 19 years in machine business. Familiar with locomotive building and rolling mill machinery. Address Box 371, THE IRON TRADE REVIEW, Cleveland, O.

YOUNG MAN; 23 DESIRES POSITION IN SALES DEPARTMENT. GRADUATE COMMERCE, FINANCE AND ACCOUNTS; STUDENT; TWO YEARS' EXPERIENCE WITH INSPECTION BUREAU. BEST OF REFERENCES REGARDING ABILITY AND CHARACTER. ADDRESS BOX 365, THE IRON TRADE REVIEW, CLEVELAND, O.

IF IN NEED OF AN A-1, UP-TO-DATE MALLEABLE superintendent, for further information address Box 340, THE IRON TRADE REVIEW, Cleveland, O.

Opportunities

Agencies Wanted and Offered | **Investment of Capital** | **Plants for Sale Lease or Purchase**

ADVERTISING RATES: 1" One Time $2.50; 2" One Time $4.75; 3" One Time $6.75; 4" One Time $8.25
RATES FOR LARGER SPACE OR LONGER PERIODS FURNISHED ON REQUEST

Menominee Ore Opportunity

We have recently finished drilling a large body of ore on the Menominee Range, Michigan. The iron content is high. Like all the ore on this range, this is a foundry ore. We want to get in touch with a furnace or a combination of furnaces that would lease this property or would join with us in forming a company to operate the property.

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Air Furnace Malleable Iron Foundry

FOR SALE

At a reasonable price and on easy terms a going successful Air Furnace, Malleable Iron Foundry. Present capacity 50 molders with ample room for increase. Located in Eastern Penna. In excellent labor field.

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Unequaled Opportunity To Secure Steel Plant

Fully equipped for manufacturing steel castings; equipped with a two-ton Tropenas Converter, overhead traveling cranes, complete machine shop and gray iron foundry, all electrically operated. Two acres under cover. Three trunk railroads switch into plant. Excellent labor conditions. 175 skilled workmen now employed. For further information.

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Mr. Foundry and Machine Shop Owner do you want business sold retail, gives at least 150% profit, wholesale 50%? I have American patents split wrought and cast iron belt pulley, light, strong, easily put up. Once used, always wanted. Patents sold Finland, Norway and Sweden.

C. L. NYBERG

Mellosa, Sweden

Sales Engineer Pittsburg District

Desires to represent manufacturers of mill machinery or mechanical specialties on a commission basis. Thorough knowledge of steel and tube machinery.

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For Sale Circular Tank Steel Discs

14"-19"-24" diameter. From ⅛"-¼" thick weighing from 50 to 130 lbs. each, according to size. Immediate delivery.

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Foundry & Machine Plant for Sale at Bellwood, Pa.

Land 90 x 446 feet. On main line P. R. R. Excellent shipping facilities. In active operation, with long established business. Office, pattern shop, machine shop, engine house, foundry, blacksmith shop, core ovens, cupolas, rumblers, machinery, tools, raw materials, etc.

GEO. M. MEYERS, Receiver
The Bellwood Manufacturing Co.
Bellwood, Pa.

For Sale One Steel Building

Width 62 ft. centers; length 300 ft. (15 bays, 20 ft. centers) height, 40' 8" to eaves; roof, truss 15 ft. deep, covered with No. 20 gauge ARMCO Iron, braced for wind and snow load. Building not enclosed on sides or ends. Suitable for mill or factory purposes.

THE COLUMBUS IRON & STEEL CO.
Columbus, Ohio

Export Agencies Wanted

An old established firm thoroughly familiar with the requirements of foreign buyers, desire to represent for EXPORT, a few responsible and competitive manufacturers of Railroad Supplies, Structural Steel, Plates, Sheets, Tin Plate, Bars, Pipe, Wire Products, Pig Iron, Billets, Builders Hardware. Selling for manufacturers at manufacturers' prices. The manufacturers to allow two percent commission on the gross sales. Can supply financial and business references.

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NEW STEEL BARS For Sale

200 tons first-class rounds 82.55 mm. in diameter, ten to twelve feet long; also 2 carloads three feet long. Analysis—

Carbon - -	.60 to .70
Mang. - - -	.60 to .80
Sulph. and Phos. -	.05 to .03

Not rejected material, no surface defects or piped. Ready for immediate shipment. Make us an offer F. O. B. cars Cleveland.

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Why not interest them now?

7

Second Hand Machinery

Used Equipment of Metal-Working Plants

ADVERTISING RATES 1" One Time $2.50 3" One Time $6.75
2" One Time $4.75 4" One Time $8.25

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Crane For Sale

25 Ton 4 Motor Electric Crane. Span 98' 5¾" G. E. Motors 220 V. D. C. 5 ton Auxiliary Hoist.

SCULLY-JONES & CO.,
Railway Exchange Bldg., Chicago, Ill.

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MOTORS
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We Buy — BIGGEST STOCK IN N. Y. — We Sell

NATHAN KLEIN & CO., INC.
208 CENTRE ST.
WILL YOU REMEMBER?

Locomotives and Dump Cars

3—36 inch Gauge Vulcan Locomotives. 27 tons 12 by 18 cylinder. First class condition.

50—Western Two Way Dump Cars. Four yards—36 inch Gauge. Good condition.

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OUR WAREHOUSE
is overflowing with immense Stock First-Class used equipment, Electric, Steam and Gas. Will send photographs. Ask us for what you want. Tell us what you have for sale.
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For Sale

No. 200-8" Heald Ring and Surface Grinder.

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For Sale

No. 2 Improved Lincoln Milling Machine. Hill Machine Co's No. 3001 6"x24" Steam Deepwell Pump.

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Before Buying Rails, Cars, Locomotives, Machinery, Equipment

See what bargains are obtainable from Zelnicker. A few rails for

Immediate Delivery

700 tons 60 lbs.
500 " 56 lbs.
400 " 35 lbs.
200 " 30 lbs.
300 " 25 lbs.

Also thousands of tons of all Sections located at various points.

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FOR SECOND HAND ELECTRICAL MACHINERY

WHAT HAVE YOU FOR SALE?

Miller Owen Electric Co., Inc.
217-219 First Ave. Pittsburgh, Pa.

FOR SALE IMMEDIATE DELIVERY

BLOOMING MILL ENGINE

Horizontal, Twin Reversing, Geared 1 to 2.

Cylinders 36" x 36" x 48"

A1 CONDITION

Ready to run.

Inquire 611 Stambaugh Building
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Wanted

Oil Engine and Generator Units

75 to 150 KW Capacity. Must be first class. Give full specifications.

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Jib Crane Wanted

10-ton capacity, mast 16' 6", jib 20 ft. long.

BERRY IRON & STEEL CO.
St. Joseph, Mo.

WANTED COMPRESSOR OUTFIT

New or second-hand. Capacity 200 cu. ft. per minute, or more, 125 lb. pressure. Outfit to be complete with motor and tank. Motor to be for A/C current, 60 cycles, 3 phase, 220 volts.

LEHIGH STRUCTURAL STEEL CO.
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Wanted to Purchase Rivet Headers

For cold rivets ⅜" diameter and smaller.

Also tack machines and tack factory equipment.

Give full description stating size, condition and price.

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FOR SALE CHEAP TWO SECOND-HAND ENGINES

1—13 x 18 Atlas four Valve Engine.
1—10 and 18 x 10 Westinghouse Compound Engine.

RUSSELL, BURDSALL & WARD BOLT & NUT CO.
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Used Equipment for Sale

1—22" x 42" heavy girder Vilter Corliss Engine.
1—12" x 30" Vilter Corliss Engine, girder type.
1—10" x 30" Vilter Corliss Engine, girder type.
1—8" x 6" Deane triplex pump.
1—2¼" x 6" Gould triplex pump.
1—4½" x 2½" x 5" Deane steam pump.
1—3" x 2½" x 4" Deane steam pump
1—3" x 1½" x 3" Burnham pump.
1—200 H. P. open feed water heater.
1—12" x 12" air compressor, 200 cubic feet per minute, 10 to 12-pound pressure.

All of the above are in very good condition and we can offer same for prompt shipment.

THE VILTER MFG. CO.,
1006 Clinton Street Milwaukee, Wis.

150 THE IRON TRADE REVIEW October 19, 1916
Second Hand Machinery
Used Equipment of Metal-Working Plants
FOR SALE
Complete Equipment of Iron Foundry
Located at
NEW BRUNSWICK, N. J
1 Beam Hydraulic Jib Crane and 2 Trolleys $397.15
1 Special Charging Scale—6 beams in steel box (Standard Scale and Supply Co.) 190.00
1 Special Charging Scale—6 beams in steel box (Standard Scale and Supply Co.) 162.00
1 Double Beam Platform Scale (Standard Scale and Supply Co.) 42.75
1 Large Cupola 275.00
1 Blower Outfit consisting of No. 11 Buffalo Blower, 60 H. P. D. C. Westinghouse Motor, switchboard box and rheostat, shafting, pulleys, hangers and belting 780.60
1 Japanning Oven complete with car, track and 2 tanks 368.89
700 Lbs. No. 6 Stars @ 3.70 25.90
1400 Lbs. No. 7 Stars @ 3.70 60.70
4550 Lbs. No. 8 Stars, medium @ 3.75 168.75
4 Small Mills complete with piping 435.00
2 Emery Wheels with geards 90.00
1 5000 LB. Ladle 32.50
Shafting, Pulleys, Hangers and Belting
Assortment of Snap Flasks, Wooden Flasks, Carrying Bones, Ladles and Shanks, Floor Rammers, etc. 1000.00
2 Stationary Boilers complete with fronts, grates 500.00
1 Lot of 100 Core Plates 137.00
3000 Lb. Misc. Core Plates @ .02½ 67.50
2000 Lb. Core Arbors @ .02½ 50.00
200 Snap Bands 1000 Lbs.
Clamps 12000 "
2300 "
Core Room Plates 4000 "
2 One-ton weights 4000 "
2 One-half ton weights 2000 "
22 Slip Pots 1430 "
70 Gangway Rails 8030 "
660 Snap Weights 23072 "
Bars and Checks 6720 "
61742 Lbs. @ .0854 344.20
We would prefer all offers to be made on the entire lot as it stands, F. O. B., New Brunswick, New Jersey. The above equipment is all in very good condition.
A. H. HUDSON, Purchasing Agent
Simplex Automobile Company New Brunswick, New Jersey
Say you saw it in THE IRON TRADE REVIEW
QUICK AND EXCELLENT RESULTS
SIMPLEX AUTOMOBILE CO.
New Brunswick, N.J. October 24, 1916.
O-7167-6
A. H. HUDSON Purchasing Agent
A. W. FRITT Asst Purchasing Agent
RECEIVED OCT 26 1916 J. D. P. ADV. DEPT.
The Iron Trade Review,
Cleveland,
Ohio.
Gentlemen,-
We have your letter of October 19th, acknowledging our order # 7167, covering advertisement in the last issue of your paper; we do not care to enter this again for the present, but wish to state however, that we are getting excellent results from this "AD", and will no doubt, in the future, use your excellent medium for disposing of any second-hand machinery we may have for sale.
Yours very truly,
A. H. Hudson
Purchasing Agent.
80

SECOND HAND MACHINERY

FOR SALE
Immediate Delivery

1—75 KW Diehl, 250 volt, Compound Wound Direct Current Generator direct connected to 14x14 Ballwood Center Crank, Enclosed Type Self Oiling Engine. Speed 270 RPM.

1—150 KW, 125 volt Direct Current Generator direct connected to 19x18 Center Crank Automatic Engine, Speed 225 RPM.

1—200 KW Sprague, 8 pole, 250 volt Direct Current Generator direct connected to 16&24x18 Ideal Enclosed Type, Tandem Compound Automatic Engine. Speed 200 RPM.

Excellent Condition.

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Iron and Steel Scrap

We offer, subject to prior sale and stock on hand, the following Relaying Rail complete with bars, at bargain prices to move quickly:

25 miles 35 pounds Relayers, in Louisiana and Texas.
10 miles 77 pounds Relayers, in Texas.
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Also other large quantities of different sections of Relaying Rail in other parts of the country.

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We own and offer for sale, subject to prior sale, eleven thro truss single track bridge spans—six 148 ft. long, and five 163 ft. 3 in. long. Bridges were constructed in 1888, of wrought iron, and are in good condition.

Well adapted for electric or small steam Railways, County Highways, etc. Complete plans and specifications will be mailed those who are interested.

If interested in any of above, phone, wire or write us.

We buy and sell steel and iron scrap

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General Offices: St. Louis, Mo.
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Generator Set
For Sale

One 325 H. P. 230 volt D. C. G. E. generator direct connected to Snow single tandem 20 x 36 gas engine, complete with switch board. Immediate delivery.

KIRK SUPPLY COMPANY
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FOR SALE

302 H. P. Babcock & Wilcox Water Tube Boiler with Murphy Stoker outfit complete. Used only four years. Size 18' long, 16' wide, 9' high. 144-4" tubes, 2-42" drums 7/16" thick, 204" long. Recent State inspection certificate 150 lb. working pressure.

The Standard Scale & Supply Co.
1676 Liberty Ave., Pittsburgh

1- American No. 1 Turret Lathe, with chasing bar.
1- Warner & Swasey Cock Grinder.
1- Gorton No. 6A Disc Grinder.
1- Brown & Sharpe Full Universal Grinding Machine, 20" swing, 7' centers.

Immediate Delivery
Subject to Prior Sale

1-42" x 48" Stroke Non-Condensing Slide Valve Mackintosh-Hemphill Engine. Has driven 112" Plate Mill.

1-50 Ton Overhead Ladle Crane with 10 ton auxiliary. Shaw Electric Drive.

4-Oper Hearth Steel Ladles, 55 tons capacity.

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1-30,000 Gallon Hemispherical Bottom Water Tank with 125 ft. steel tower, complete with gas engine and pump.

(The foregoing are all in good second-hand condition)

Complete Bolt and Nut Machinery, never in service.

Address Inquiries to
Rolling Mill & Steel Works Dept.
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For Sale

1—No. 4 Sixty inch shell Whiting cupola and Connersville Blower for operating same.
1— Five ton, 20 ft. Span, Whiting Hand Traveling Crane.
1—Byram-Callieu 42" Shell Cupola and No. 9 Buffalo Fan for operating same.
2—Emery Wheel Stands.
1—Sly Exhaust Tumbling Mill 48" x 24" with ¾" plate.
1—Byram Exhaust Tumbling Mill 50" x 38" with ¾" plate.
1—Byram Square Exhaust Tumbling Mill 48" x 26" with ¾" plate.
4—Adams-Farwell Stationary Hand Squeezers.

All the above are in A-1 condition and for immediate delivery.

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In stock for immediate delivery

LATHES
1—20 x 10 New Haven, Plain change, compound rest (new).
1—18 x 8 Mueller Dbl. Back Gear, quick change (new).
1—16 x 8 Hamilton Quick Change Gear (new).
1—14 x 6 Hamilton Quick Change Gear (new).
1—14 x 6 Hamilton Quick Change Gear taper attach. (new).
1—14 x 6 Hamilton Quick Change Gear taper attach. pan bed (new).
1—14 x 6 Hamilton Pin. Chg. Gear (new).
2—13 x 6 Worcester Plain Change Gear (new).
1—9 x 12 Porter Cable, compound rest (new).
1—11 x 5 Blount Speed Lathe (new).

SCREW MACHINES
1—2-in. Geared Fric. Head Power feed to turret (new).
1—1½-in. Geared Fric. Head Power feed to turret (new).
2—1-in. Plain Head, wire feed (new).
2—⅞-in. Plain Head, wire feed (new).

BENCH LATHES
2—No. 5½ Sloan & Chace, Cpd. slide, 3 speed c/s, 10 collets (new).

BENCH MILLER
1—No. 2 Sloan & Chace Tool Room, index centers and vise (new).

PUNCH PRESSES
2—No. 5 Toledo open back presses (new).
2—No. 2½ Toledo open back presses (new).
1—No. 4 Baxendale (new).
1—No. 3 Zeh & Hanneman Inclin. Press.
1—No. 68 N Bliss Press.

MILLING MACHINES
1—No. 12 Garvin Plain Miller (new).
1—No. 0 Rockford Plain Miller (new).
3—Standard Hand Millers, vise and arbors (new).
1—No. 15 Garvin Plain (new).
1—No. 2 Plain Cincinnati.
1—No. 2 P & W Lincoln Type.

DRILL PRESSES
2—20-in. Barnes Sq. Base, Lever and Worm Feed (new).
1—20-in. Barnes Sq. Base, B. G., S. F. & A. S. Geared tapper (new).
1—3 Spdl. Avey Ball Bearing (new).
6—Myers Sensitive Bench Drills (new).
3—Barnes Sensitive Bench Drills Friction (new).
2—20-in. Buffalo B. G. (new).
1—36-in. Aurora Slid'g Hd., Gear'd Tap'r
1—24-in. Aurora Sliding Head.

TURRET LATHES
2—21-in. Gisholt Style H Turret Lathes.
1—12-in. W & S Plain Turret Lathe.
1—2 x 24 Jones & Lamson gd. hd. flat tur.

TOOL ROOM GRINDERS
1—Capital Internal Grinder (new).
1—No. 2 Hartford Surface Grinder (new).
1—Steno. Surface Grinder, Duplex, 2 magnetic chucks (new).

GRINDERS
2—6 x 32 Norton Plain Grinders.
2—8-in. Blount Grinders (new).
2—10-in. Blount Grinders (new).
1—12-in. Blount Grinder (new).
2—No. 6 T Sterling (new).

WALL RADIAL
1—Canedy Otto 3½-ft. (new).

CHUCKING LATHE
1—7 x 14 Potter Johnson Automatic.

MISCELLANEOUS
1—4-in. Whiton Centering Machine.
1—10-in. Pratt & Whitney Trav. Hd. Sh.
1—6-in. Boynton & Plummer Shaper.
1—No. 2 Hawk Eye Helve Hammer.

COLD ROLLED STEEL

We have an extremely large stock of new round, flat, square and hexagon in our Rochester warehouse. Write for quotations on immediate deliveries.

We have been in the machine tool and supply business for 20 years and believe that we can serve you to your advantage.

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207 State St. Rochester, N. Y.

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Where orders may be secured for stampings, iron, steel or brass castings, dies, tank and boiler work, construction of special machines, building of patterns and models, experimental work, etc.; where special work may be secured for prompt delivery.

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Gears
Up to 64", Spur, Spiral or Worm
ACME GEAR WORKS
132 Mott St. New York, N. Y.

We Specialize In
Fine Gray Iron Machine Castings
2 Pounds to 2000 Pounds
PROMPT SERVICE ASSURED
BENTON IRON & BRASS FOUNDRIES
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Machine Work Wanted
FOR LATHES, MILLING MACHINES
SHAPERS, DRILL PRESSES
Send Blue Prints or Samples for Quotations
Prompt deliveries Prices right
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GOOD WORK
JIGS
FIXTURES
SPECIAL TOOLS
FORMED CUTTERS

Johansson Gaging System
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Wanted
Work to Fabricate
Structural steel, fire escapes, steel doors and frames, steel derricks, towers, etc. Shop equipped with cranes, shears and punch presses, drill presses, lathes, forges, pneumatic and electric tools, power saws, cutting and welding torches. We have a good tonnage of structural shapes and plates in stock and are prepared to do miscellaneous iron and machine work.
THE KLEIN IRON WORKS COMPANY
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OUR SPECIALTY
Grey Iron Castings, up to 3000 lbs.
Superior quality, machine or hand moulded, sand blasted, pickled or tumbled. On good tonnage we will make special moulding equipment that will warrant you the best price and most efficient service. Patterns made of wood, brass, aluminum or iron.
Manufacturing contract machine work solicited. It will pay to write us.
NORTH WALES MACHINE CO., Inc., N. Wales, Pa.

HAND OR MACHINE MOLDED
Gray Iron Castings
One Ounce to One Ton
Quality Unsurpassed—Quick Delivery
Contract Work Solicited
CHAS. E. DAVIS
Rutland Vermont

Brass Castings
All kinds of Bronze, Steam Metal Bronze or Yellow Brass Castings.
Any kind of casting furnished in the rough or machined to your specification.
The "S-C" Regulator Co., Fostoria, Ohio

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CASTINGS
Gray Iron, Brass, Bronze, Aluminum
GEAR CUTTING—GEN'L MACHINING—PATTERN MAKING
Particular Patronage Desired
GYRO METAL WORKS, NORFOLK, VA.

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Up-To-Date Factory For Sale

Located in middle of best agricultural district in a live town, having five other factories.

Factory Site—Six Acres.
Machine Shop—82 x 142 feet.
Foundry Building—60 x 144 feet.
All buildings, brick and steel construction, steam heated, modern.
Full machine tool equipment, electrically driven everything necessary for making gas engines or tractors.
Foundry up-to-date, five to ten ton capacity daily.
Good labor supply.
Ready for operation.

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These are the men you want to interest—and it is the MANUFACTURING SITES department of *The Iron Trade Review* that will place the advantages of YOUR city before them.

It will be a pleasure to hear from you.

Manufacturing Sites Department
THE IRON TRADE REVIEW
CLEVELAND OHIO 11

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Where orders may be secured for stampings, iron, steel or brass castings, dies, tank and boiler work, construction of special machines, building of patterns and models, experimental work, etc.; where special work may be secured for prompt delivery.

ADVERTISING RATES: 1" One Time $2.50; 2" One Time $4.75; 3" One Time $6.75; 4" One Time $8.25.
RATES FOR LARGER SPACE OR LONGER PERIODS FURNISHED ON REQUEST

SERVICE
That is what we can give you in our Pattern Department. Wood or Metal. Specialty Match Plates. Metal Spinning. Send your blue prints to us first—We can save you money.
THE NEWARK STAMPING & FOUNDRY CO.
Plant No. 2 Newark, Ohio

We are looking for outside work for our
Machine, Pattern and Smith Shops
Brass and Gray Iron Foundry
Send Blue Prints for estimates.
Klotz Machine Co.
Sandusky, Ohio

Metal Stampings
DIES TOOLS JIGS
Let Us Estimate On Your Work
LANSING STAMPING & TOOL CO.
Dept. A LANSING, MICH.

MACHINE WORK WANTED
Our equipment consists of
two 16" and two 17" screw cutting lathes; one 22" turret lathe, one 48" lathe; one 36" drill; two planers, one 36" x 36" and one 24" x 24".
With this complete equipment and our broad experience we can handle practically any kind of machine work.
Can you use our facilities?
American Twist Drill Co.
Laconia, N. H.

Finest Quality
Gray Iron Machine Castings
Foundry in Central West
Our Specialty Machine Tool Castings from 2 lbs. to 12,000 lbs. each.
Prompt Service
Address Box 303
THE IRON TRADE REVIEW, Cleveland, O.

Screw Machine Work
Brass Castings
Turret Lathe Work
Prompt deliveries—right prices
Send blue prints for quotations
Hill Pump Valve Company
Archer Ave., Canal & 23d Sts., Chicago, Ill.

CASTINGS
Gray Iron—Brass
PROMPT DELIVERIES
Also Pattern Making and Machine Work
THE
Scranton Pump Company
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Stamping and Drawing
Dies, punches and special tools. Special equipment to manufacture all kinds of specialties.
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Goebel and Fulton Streets, North Side
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American Metallic Pattern Co.
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Special attention given gated work.

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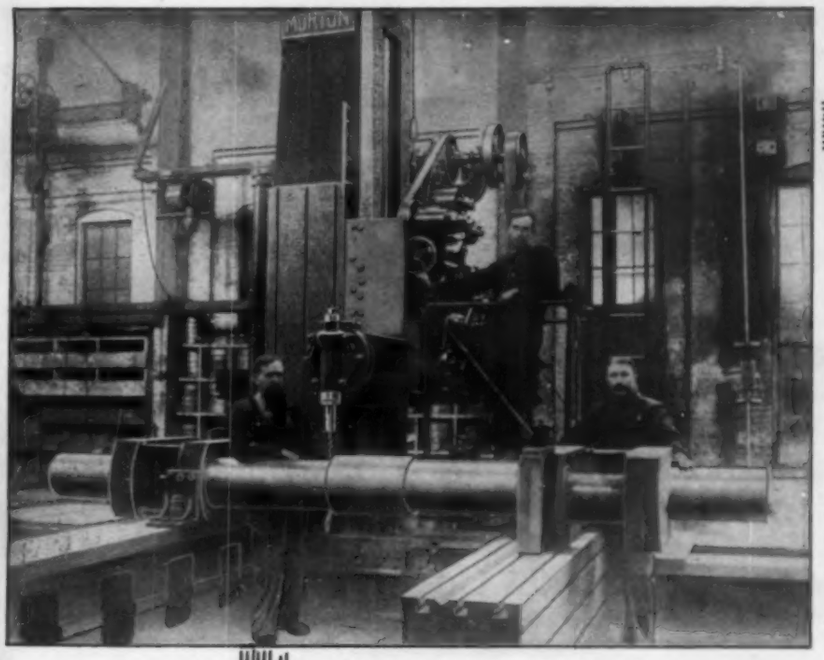

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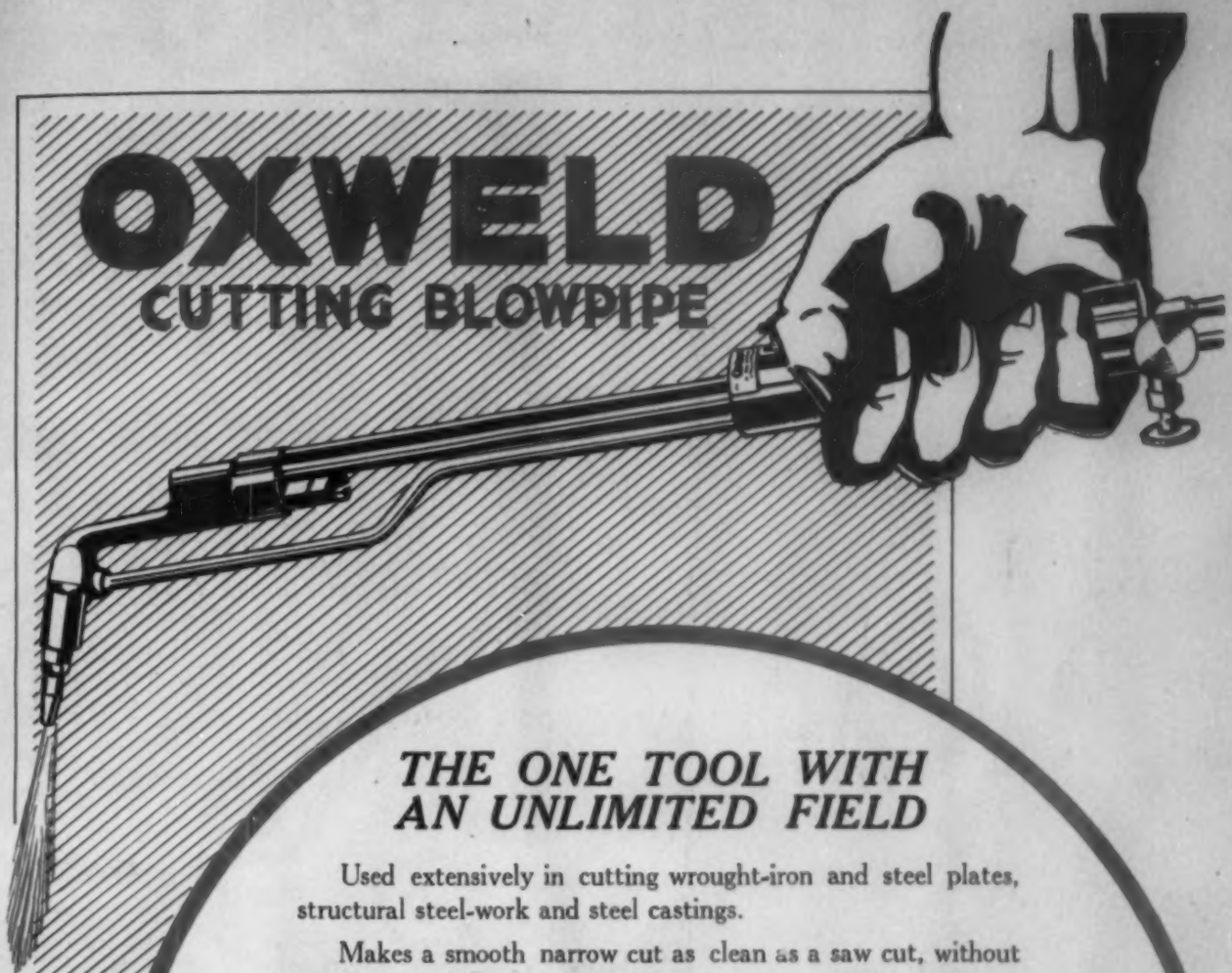

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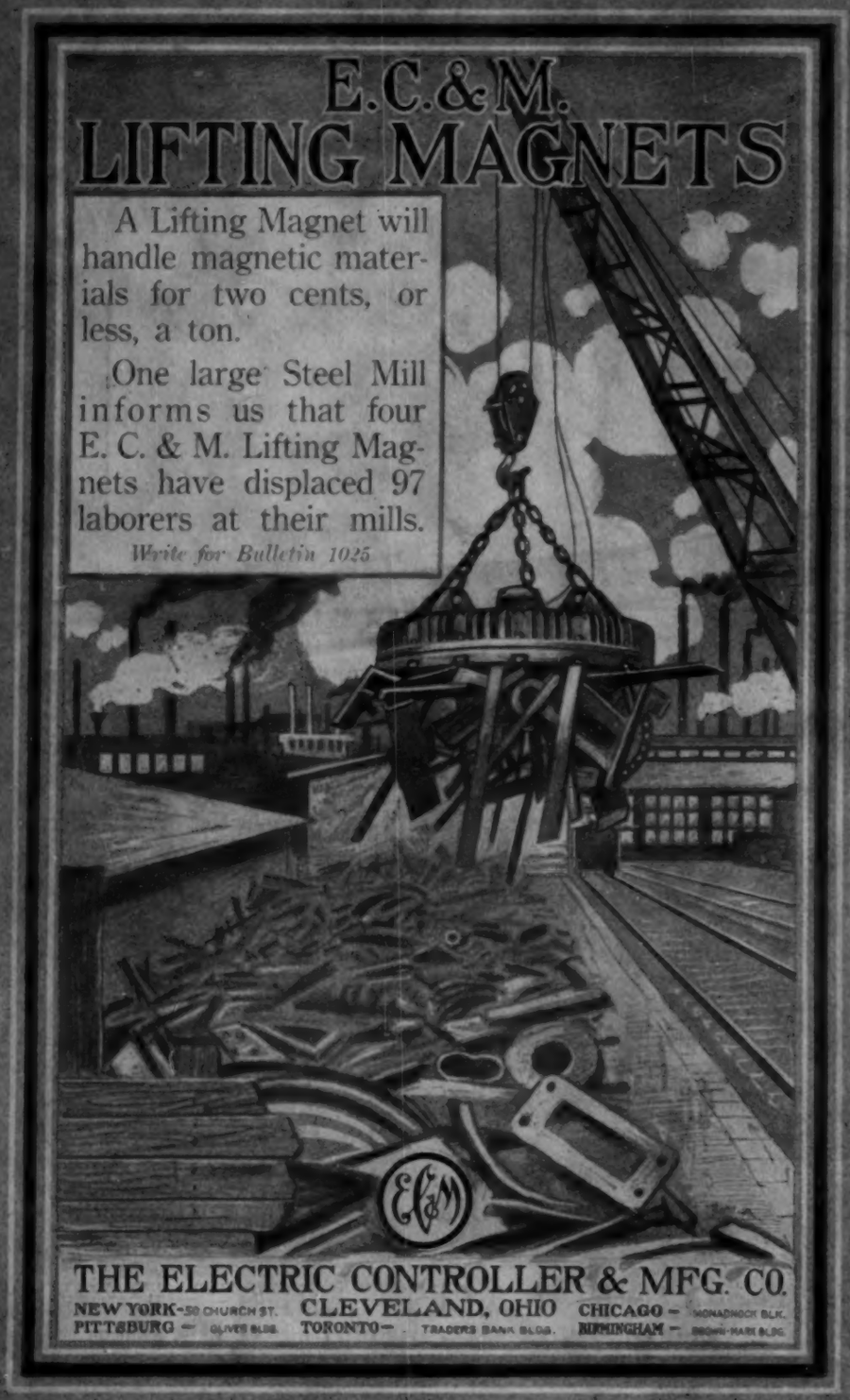
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